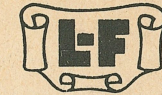


# INSTRUCTIONS

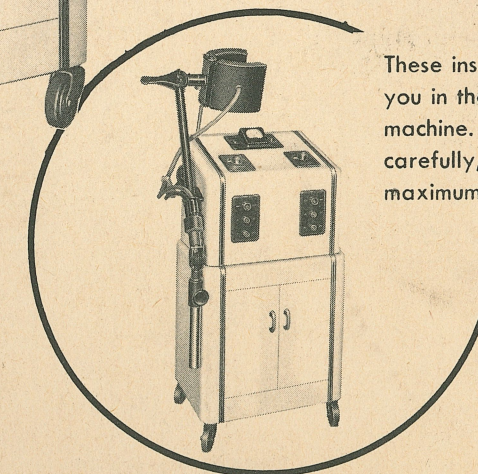
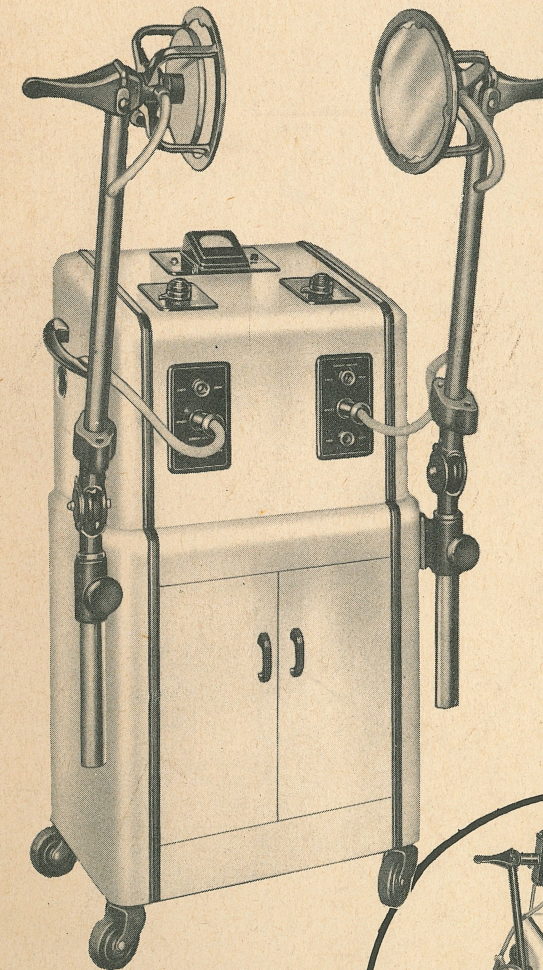
FOR SETTING UP AND OPERATING



SW-227

## *Frequency Controlled*

SHORT WAVE DIATHERMY UNIT



These instructions have been prepared to assist you in the safe and efficient operation of your machine. It is to your advantage to study them carefully, following suggestions as given, so that maximum satisfaction is obtained from the unit.

THE LIEBEL-FLARSHEIM CO.

303 WEST THIRD STREET CINCINNATI 2, OHIO



**INSTRUCTIONS**  
FOR SETTING UP AND OPERATING



**SW-227**

*Frequency Controlled*

SHORT WAVE DIATHERMY UNIT



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SECTION I  
PRELIMINARY INFORMATION

Diathermy is the art of producing heat within body tissues by passing a high frequency electrical current through the part. Because of the very high frequencies employed, there is no muscular or nervous reaction. The heat results from resistance offered by the tissue to the passage of the electrical current.

Modern Short Wave diathermy machines, employing radio frequency (millions of cycles per second) are capable of inducing electric currents within the tissue without the necessity of metallic contact with the skin. Thus, insulated applicators are used and spaced away from the skin to promote safety, comfort and convenience.

Short Wave diathermy induces these currents in either of two ways:

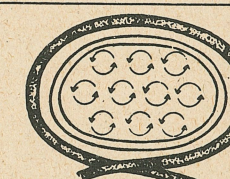
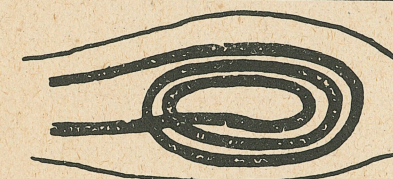
- (a) With magnetic induction electrodes (using inductance cable or Treatment Drum)
- (b) With condenser electrodes (capacitative) (using pads or Spaced Plates)

The L-F Model SW-227 Short-Wave Diathermy Unit provides currents for both Magnetic Induction Electrodes and Condenser Electrodes and is, therefore, capable of operating all types of applicators.

Magnetic Induction Electrodes

In this type of application, a continuous conductor is used (usually formed into a coil) -- i.e., Inductance Cable or Treatment Drum. When high frequency alternating current flows through this conductor, an intense magnetic field surrounds it. The magnetic field builds up and collapses several million times per second and as it so fluctuates, the magnetic lines of force in the field are moved with great speed. When a body part (or any other conductor) is brought within this moving magnetic field, circulating electric currents (eddy currents) are induced in the conductive material, and a rise in temperature results. No current enters the body directly from the electrode or leaves the body to the electrode.

DIAGRAMMATIC EXPLANATION OF ENERGY DISTRIBUTION WITH CABLE OR DRUM



"Pancake Coil" or Treatment Drum. Showing eddy currents in tissue surrounded by cable.



Cable wrapped around tissue mass.

Showing eddy current effect in conductive tissue.



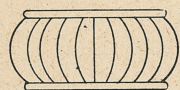
### Condenser Electrodes (Capacitative).

The "Condenser" Electrodes draw their name from the fact that when a pad (or Spaced Plate) is placed adjacent to a body part; the electrode surface - the air space (or spacer material) - and the surface of the body next to the electrode, form a Radio Frequency Condenser.

When a body part is placed between two such electrodes, it is actually in the High Frequency Circuit of the machine and current will flow through the body part from "one electrode to the other".

The condenser type applicators are applied opposite to each other or in the same plane. Variations in spacing and placement permit concentration or dispersion of heating, as desired.

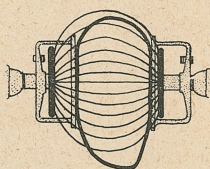
### DIAGRAMMATIC EXPLANATION OF ENERGY DISTRIBUTION WITH PADS OR SPACED PLATES



Schematic representation of current flow between two opposite pads.



Current flow between two pads in same plane.



Concentrating energy by different spacings. More heat is produced at closer application.

## SECTION II SETTING UP AND PREPARING MACHINE FOR USE

The Complete SW-227 is packed in three cases as follows:

- 1 - Wooden Case containing the Unit Proper.
- 1 - Large Corrugated carton containing Sub-Cabinet and Counterbalanced Supporting Arm (or Arms). All applicators, including Hinged Treatment Drum and Drum Lead Clamp, (Spaced Plates, guards and transparent discs - when ordered) are packed in the cupboard compartment of the Sub-Cabinet.
- 1 - Special Corrugated tube carton containing oscillator tube.

Inspect all cartons for damage caused by shippers. If damage is found; immediately call the Shipper's Claim Agent. Preserve all packing for inspection by the Claim Agent. The customer should file the claim.

### Assembly.

Unpack large corrugated carton containing Sub-Cabinet and accessories. Note that the Counterbalanced Arm (or two Arms if machine is so ordered) is packed in a separate carton slipped into the inside front cover of the large carton.

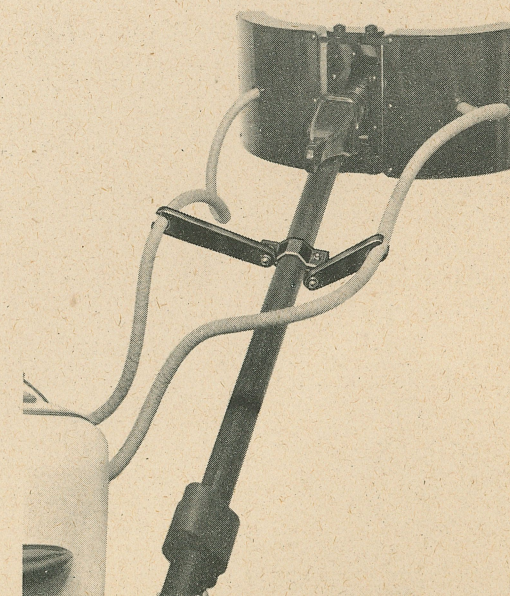
Remove the cover of the wooden box and lift away top brace that holds unit down in case. Lift out the machine and set it on top of the Sub-Cabinet. Secure the machine to the Sub-Cabinet by means of two thumb screws supplied in an Instruction envelope packed in the Sub-Cabinet drawer.

Install Arm or Arms in brackets on Sub-Cabinet. To attach the Hinged Treatment Drum to the Arm (or either Space Plate Arm); loosen the thumb screw on the Hinged Drum metal clamp; slide the opening in the clamp over the square boss on the side of the arm head; turn the clamp 1/8th turn to lock it in position and tighten the clamp with the thumb screw.

### The Drum Lead Clamp

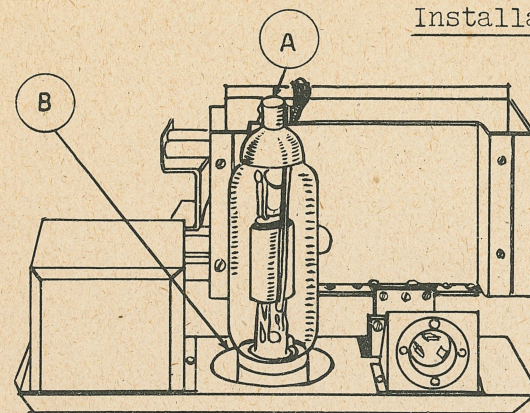
The Drum Lead Clamp is provided as a means of keeping the Drum Leads separated and to prevent their touching the back of the Drum or any other conductive parts during the treatment. If the leads are allowed to touch; the rubber insulation will heat, melt or burn, depending on the severity and duration of the contact.

The Drum Lead Clamp should be installed on the arm holding the Hinged Treatment Drum in the manner shown in the illustration (Fig. ). Tighten the clamp so that it cannot turn or slide on the arm during use.





### Installation of Tube



Place tube in socket (B). The pins in tube base fit slots in socket. Push down tube and turn 1/8 turn clockwise. Braided wire lead is then slipped on cap terminal on tube at (A). Replace back before plugging in supply line.

When tube has been installed, replace the back panel by holding the top edge slightly away from cabinet so as to engage the two guides (at the lower sides of the panel), into the cut-outs in sides of the cabinet opening. Then push the panel downward into position, fastening with the two screws previously removed.

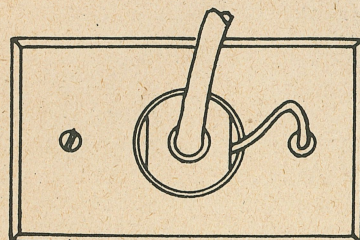
### Instructions for Grounding Cabinet.

It is accepted practice to ground all electrical apparatus housed in metal cabinets. Accordingly, the necessary wires and screws for grounding the apparatus to a grounded wall base outlet, are included with the SW-227. These will be found in an envelope in the storage compartment of the machine.

Because most modern wall box receptacles are grounded, a good ground can usually be had by connecting the green lead on the male end of the supply cable directly to the receptacle box cover (see example one and two below). However, in some instances, it may be necessary to connect to a radiator, steam line or water pipe to be sure of a proper ground (see example three below).

To be sure about which method of grounding to use, determine first whether or not your wall box receptacle is grounded. Remove the cover and see if a metal pipe or "BX" flexible cable is connected to the outlet box. If so, you may make your ground connection to the box as in example one or two. If not, or if you are unable to determine whether the wall box is grounded, use method under example three -- or consult building superintendent, architect or electrician.

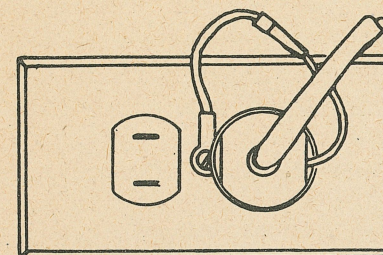
#### No. 1 - Single Outlet Receptacle with Ground.



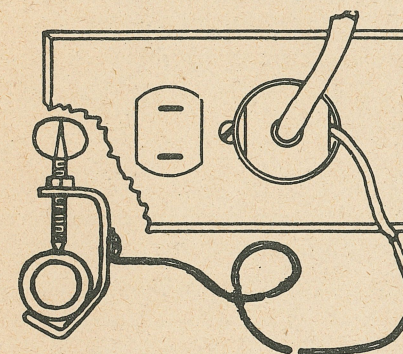
#### Example 1. Single Receptacle with Ground.

Remove one of the screws from the outlet plate. Replace this screw with the threaded end-piece from the green grounding lead. This end-piece can be pulled off the green lead for the purpose of screwing it into the wall plate. Then, push the sleeve back over the end-piece and the cable is grounded.

#### No. 2 - Double Outlet Receptacle with Ground.



#### No. 3 - Outlet Receptacle Without Ground.



### Connection to Power Supply.

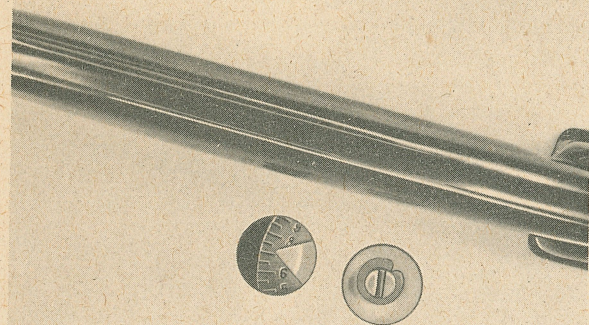
Unless otherwise specified on nameplate, this machine is for operation on Alternating Current of 105 to 125 volts, 60 cycles. BE SURE SUPPLY MATCHES RATING OF THE MACHINE SHOWN ON NAMEPLATE. If only D.C. current is available, a rotary converter of 13 amperes capacity, supplying 115 volts, 60 cycles, A.C. is required.

After you have made sure that power supply is correct for this machine; plug female plug of line cable into male receptacle on rear of machine; plug male plug of line cable into appropriate female receptacle of power supply (usually a wall base outlet).

Before energizing the machine, be sure you have read Section III and IV of these Instructions. Then energize the unit, adjust "Trimmer" to frequency and machine will be ready for use.



Method of adjusting the "Trimmer" to set machine on Proper Frequency.



The "Trimmer" control is accessible through two holes on the left side of the cabinet, under the handle and just ahead of the line voltage adjustment switch. Remove the two caps covering these holes by sliding a flat blade under the edge of each one and prying out. One opening exposes a dial and pointer. The other reveals a slot in the end of the Trimmer adjustment shaft. This slot will receive the edge of a dime if a screw driver is not handy. The object of the trimmer control is to set the basic frequency of the oscillator at the exact center of the frequency band allocated by F.C.C. This is explained in Section III:

On installation of this unit or after any change of a circuit component such as an oscillator tube, the frequency of the oscillator should be adjusted to the exact center of the allowable radio frequency band. This procedure is as follows:

1. Be sure back panel is in place and fastened with screws.
2. Disconnect all applicators.
3. Plug in the Supply Cable.
4. Turn Resonance Control completely to right (clockwise).
5. Turn Main Switch (Power Control) to "Hold" position and leave for 5 seconds.
6. With Power Control in "Hold" Position, check and adjust line voltage.
7. Turn Power Control to Setting "1" and wait 3 minutes.

If buzzer operates when machine is first turned to Setting "1", the Trimmer is probably set outside of the allowable band limit. Turn the trimmer dial 2 divisions at a time (returning the Power Control to Hold position and then back to Setting "1" after each change of dial position) until unit will operate (no buzzing); then proceed as per step 8.

8. Insert a screwdriver (or dime) in slot of Trimmer adjustment shaft and turn slowly clockwise to reduce numbers until buzzer sounds. (Wavemaster operates, indicating lower limit of band.)
9. Note and record Trimmer Dial setting at point where buzzer first sounds.
10. Advance Trimmer Dial (Counterclockwise) three divisions.
11. Return Power Control to "Hold" Position to stop buzzer. (This resets the Wavemaster circuit.)
12. Again advance Power Control to Setting "1".
13. Advance Trimmer adjustment shaft slowly counterclockwise to increase numbers until buzzer sounds again (Wavemaster operates, indicating the upper limit of band.)
14. Note and record Trimmer Dial setting at point where buzzer starts to sound.

15. Turn Power Control to "Off" position.
16. Set Trimmer Dial halfway between band limits recorded in steps 8 and 13.

Example: If lower limit is 4 and upper limit is 11, set Trimmer Dial at half-way point -- which, in this case, would be 7-1/2.

Note: In rare cases, a particular oscillator tube may cause the unit to shift frequency so that one or the other band limit lies beyond one extreme of the Trimmer Dial. This is of little consequence. Find upper or lower band limit and set the Trimmer Dial 2-3/4 divisions below or above it (as the case may be) so that buzzer does not sound.



SECTION III  
TECHNICAL CHARACTERISTICS

General

The Liebel-Flarsheim SW-227 FREQUENCY-CONTROLLED Short-Wave Diathermy Unit employs a single (type - 468) oscillator tube in a self-rectified, self excited oscillator circuit. The SW-227 is not a crystal-controlled machine. Its frequency stability is inherent in its design; and frequency shift is effectively controlled by an electronic device - The L-F Wavemaster.

The oscillator circuit and all necessary controls are contained within a ventilated all metal cabinet that is mounted on top of a matching sub-cabinet, which provides a mounting for the adjustable arm (or arms) and storage space for applicators and accessories.

1. Frequency.

The Model SW-227 operates within the 27.32 megacycle channel allocated by the Federal Communications Commission for use by this type of equipment. The wave length is 10.98 meters.

2. Method of holding frequency within allocated channel.

The SW-227 oscillator circuit incorporates an original L-F electronic device known as the "Wavemaster". The L-F Wavemaster prevents operation outside of the specific Radio Frequency band allocated by the Federal Communications Commission (i.e., 27.185 megacycles to 27.455 megacycles). The Wavemaster continually monitors the upper and lower limits of the 27.32 megacycle channel. It allows the SW-227 to operate with complete freedom within the limits of the channel, but if the machine should, for any reason, approach either band limit, the Wavemaster immediately reduces the power to zero and sounds a warning buzzer. This protective device guarantees the user that his machine can never operate except on proper frequency.

3. Method of setting oscillator on fundamental frequency.

A primary frequency adjustment device or "Trimmer" is incorporated in the circuit; and has "screw driver" adjustment control accessible through the side of the machine. This "Trimmer" affords adjustment to set the nominal frequency of the oscillator at the exact center of the 27.32 megacycle band. (For complete instructions on method of adjustment, see Section II). This adjustment need be done only on installation of the unit, and after repairs or tube replacement.

4. Applicators operate at Resonance.

Unlike prior Short-Wave Diathermy equipment, the Model SW-227 is designed to operate all applicators at resonance. Heat production is thus more efficient; but more important is the fact that when applicators are critically tuned, any movement on the part of the patient will de-tune the circuit and reduce power. This removes the danger, that movement on the part of the patient might increase the power beyond patient tolerance, as is the case with many other Short-Wave Diathermies.

5. Power Output.

The SW-227 is rated at approximately 300 watts output. This is ample for even heaviest treatments because of the unusual efficiency of operation, due to the fact that the circuit is adjusted to resonance for all loads. Control of the power is smooth, simple and precise.

6. Protective Devices.

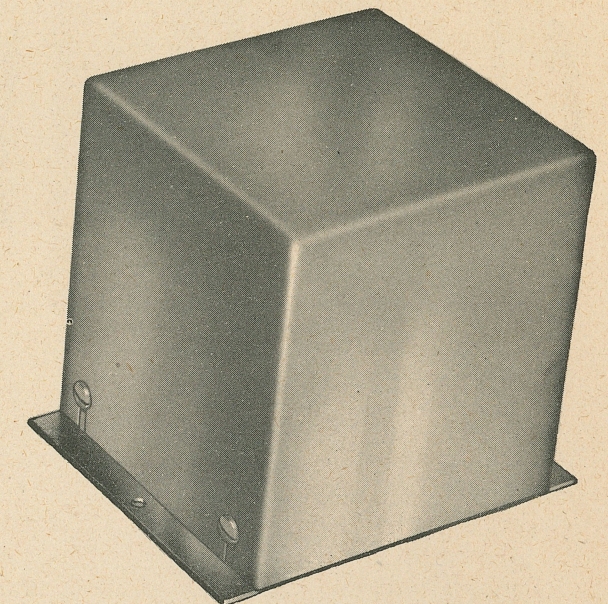
(a) The Protect-A-Tube.

The SW-227 incorporates the Patented L-F Protect-A-Tube which automatically reduces the power and sounds a warning buzzer whenever some unusual condition threatens to create an overload of tubes or circuit.

(b) The Wavemaster.

The L-F Wavemaster automatically reduces the power to zero and sounds a warning buzzer whenever any unusual condition alters the frequency of the oscillator so that it threatens to shift outside the allowable frequency limits.

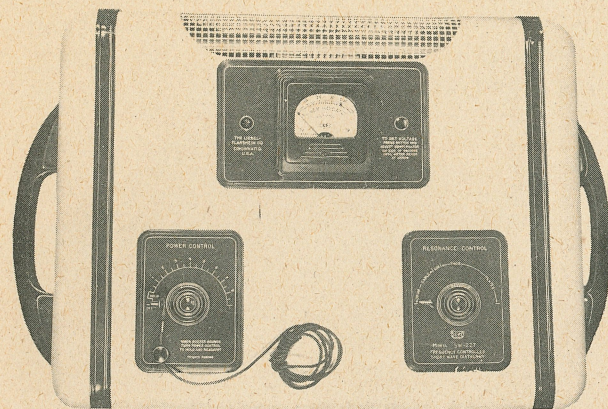
These two circuits are contained within a sealed metal box, with plug in electrical connections, located in the rear of the oscillator cabinet.



L-F "PROTECT-A-TUBE"  
and WAVEMASTER



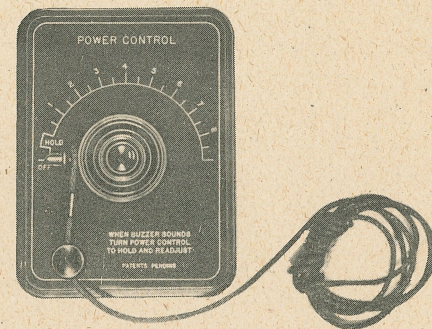
SECTION IV  
DESCRIPTION OF CONTROLS



All operator's controls, with exception of the line voltage compensator, are located on the slanted top panel of the unit. (See illustration at left.)

Power Control.

This control, located on the left hand side of the slanted top panel, combines the On-Off switch with a "filament on" station marked "Hold" and a Power Control scale with arbitrary calibration "1-9". When the control is turned from Off to "Hold", the filament of the oscillator tube and the pilot lamp is lighted. The control should be left in "Hold" position approximately 5 seconds before advancing into Power Control range. If operator does not wait until filament has heated, the Protect-A-Tube will operate and it will be necessary to return to "Hold" position for two or three seconds before again advancing to Power Control range. At the end of each treatment, this control should be turned to "Off" position.

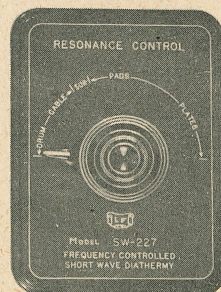


Power Control

A "Patient Pull-Off Cord" is attached to this control to allow the patient a means of reducing the heat or turning machine Off if he is left unattended.

Resonance Control.

On the right hand side of the slanted top panel is the Resonance Control which provides a means for "tuning" each treatment application for maximum efficiency. In operation, the Resonance Control is first turned to the general position indicated for the type of applicator used; i.e., left portion of the dial for Hinged Drum or Cable; right portion of the dial for Pads and Spaced Plates. An Orificial applicator will tune similar to a "Pad". (See page 22 for special instructions for Surgery.)



Resonance Control

The main switch is now turned to "Hold" for five seconds; then to the mid-range of the Power Control Dial. Thereafter, the Resonance Control is carefully adjusted to produce the maximum obtainable reading on the meter. This is the point of resonance for the treatment load. The Power Control is then adjusted to obtain the desired heat, using the patient's tolerance as a guide.

This operation very closely resembles the procedure for operating a radio. The Resonance Control "tunes in" the treatment load almost exactly like a station is "tuned in" on a radio. The Power Control is then adjusted for "volume".

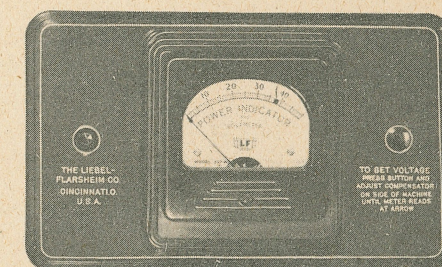
Important: When "tuning in" the SW-227, the operator should stand at least 12 inches away from the applicators or leads so that his body capacitance does not enter into the high frequency field -- causing false tuning which would change the meter reading as he steps away from the machine.

Power Indicator and Voltmeter.

The meter assembly, with pilot light and push button, is at the top center of the control panel. This meter performs two functions:

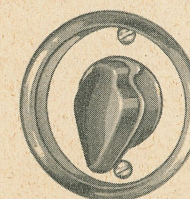
(a) Power Indicator - which gives a reliable relative indication of the amount of energy delivered to the patient.

(b) Voltmeter - When the push button (to the right) is depressed, the meter indicates the tube filament voltage, and should always read in the black section of the scale (37-39).



Power Indicator & Voltmeter

Line Voltage Compensator.



A line Voltage Compensator is located on the left side of the unit, toward the rear of the cabinet. Line Voltage should be tested by depressing button to right of meter. If the meter does not read in the black section of the scale (with button depressed), the compensator switch should be turned until it does read in the black section. The Power Control should be in "Hold" position during this operation.

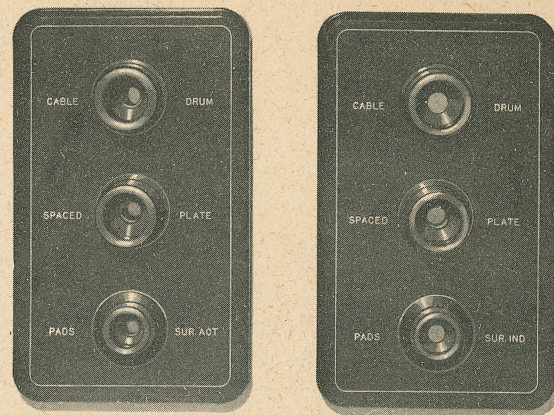


### Output Terminals

are located on the front of the cabinet, plainly marked for connection of the various applicators used with this machine. Connect to "Cable-Drum" terminals when using Inductance Cable or Hinged Treatment Drum. Connect to "Spaced Plates" terminals when using Air-Spaced Plates. Connect Pad applicators to "Pads" terminals. (See special instructions for Orificial Applicators, Pg. 21 and for Surgery, Pg. 22).

### Supply Line Connection.

At lower back of the upper cabinet is a male receptacle to receive the female plug of the supply cable.



### SECTION V PROCEDURE FOR ALL TREATMENTS

1. Be sure Power Control of Machine is in "Off" position.
2. See that both ends of supply cable are solidly connected to machine and to wall receptacle. Connect green lead of supply cable to ground.
3. Position applicator or applicators to Patient, with desired spacing, making sure that Patient is in comfortable position to insure minimum movement.
4. Connect applicator lead plugs into proper outlet terminals on front of machine, pushing plugs all the way in. Be sure that applicator leads do not cross and that they are spaced well away from each other and from any conductive material.
5. Turn the Resonance Control to the section of its dial that is indicated for the particular applicator or applicators being used.
6. Turn Main Switch "Power Control" to "Hold" position and leave for approximately 5 seconds.
7. With Power Control in "Hold" position, depress button located to right of meter, to indicate line voltage. If the meter does not read in the black section of the scale (with button depressed), the line voltage compensator switch should be turned until it does read in the black section.
8. Advance Power Control to Dial Setting indicated below for applicator (or applicators) in use:

#### Dial Setting

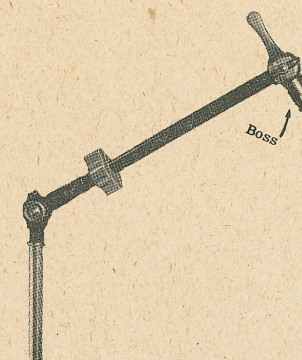
Cable, Hinged Treatment Drum or Orificial Applicator. . . . .	4
Pads or Air-Spaced Plates . . . . .	6

9. While standing at least 12" away from the applicator (or applicators) and the applicator leads, adjust the Resonance Control slowly back and forth until you obtain a setting that produces the maximum meter reading. This procedure "tunes" the applicator (or applicators) to resonance for the treatment load and spacing. (Pay particular attention to this step in the procedure. Tune slowly so that you can recognize "the maximum obtainable meter reading" for that load, spacing and Power Control setting.)
10. Adjust the Power Control until the Patient feels a moderately warm sensation. While Patient's tolerance is the most reliable guide to dosage, also pay attention to meter reading, because treatments can thus be duplicated and experience will teach you to use the meter more and more as your guide.
11. Attend Patient closely for first few minutes because it will probably be necessary to reduce the power after heat begins to build up. To reduce heat, turn Power Control back (counterclockwise).

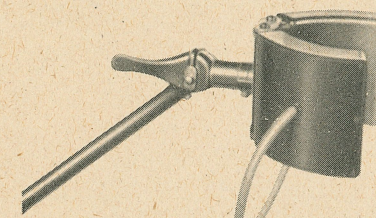


12. If you leave the Patient unattended, have him hold the Patient Pull-Off Cord, so he may turn off the machine if he becomes uncomfortable or if Protect-A-Tube or Wavemaster operates (Buzzer sounds).
13. If the Patient changes his position in relation to the applicator (or applicators) the output circuit will be de-tuned and the meter reading will drop. If it is not necessary to re-position the Patient; merely retune the circuit with the Resonance Control and adjust Power Control to desired Meter reading. If it is necessary to re-position the Patient, first turn the Power Control to "Off" position, then repeat steps 6, 8, 9, and 10 to start the treatment again.
14. If buzzer sounds during treatment, it means that something has happened to cause the Protect-A-Tube or Wavemaster to operate. To stop buzzing, turn main switch to "Hold" position. Then check applicator, retune and re-adjust power. (Steps 8, 9 and 10.)
15. At end of treatment, turn Power Control to "Off" position before removing applicators from Patient or disconnecting them from the unit.
16. Allow Patient to "cool off" for about 30 minutes before going outside, particularly in cold weather.

SECTION VI  
TREATMENT APPLICATIONS  
HINGED TREATMENT DRUM METHOD  
Of Applying Diathermy Treatments



**Adjustable Arm**



**Hinged Drum**

The Hinged Treatment Drum contains two pancake coils which are interconnected. It is mounted on the Adjustable Supporting Arm which makes its placement extremely simple, speedy and convenient.

The Hinged Treatment Drum operates by the electro-magnetic induction principle, the same as the Inductance Cable. (See page 3). This Drum applicator being hinged, fits any contour of the body; such as hip, shoulder, lower back, bronchial area and half chest. Treatments are easier, safer, and better -- with more comfort to the patient.

The Hinged Treatment Drum is standard equipment with the No. 2654 and 2656 combinations and, because of its adaptability, can be used for practically every induction type treatment.

When attaching this Drum to the Supporting Arm, note that there is a small projection (or boss) at the side of the crosspiece where the Drum attaches. The open portion of the attachment clamp on the back of the Drum passes over this boss and the clamp is then slightly rotated before tightening so that the Drum will not fall off the arm even though the clamp should be loosened.

The Hinged Treatment Drum leads are connected to the "Cable-Drum" terminals of the machine. The Drum Lead Clamp should be mounted at about the center of the Counter-balanced Arm to allow uniform spacing between the Drum leads.

The Hinged Drum is designed to be used against the part being treated, except that a layer of toweling or Kleenex should be placed between the drum and skin for sanitary reasons and to absorb perspiration.

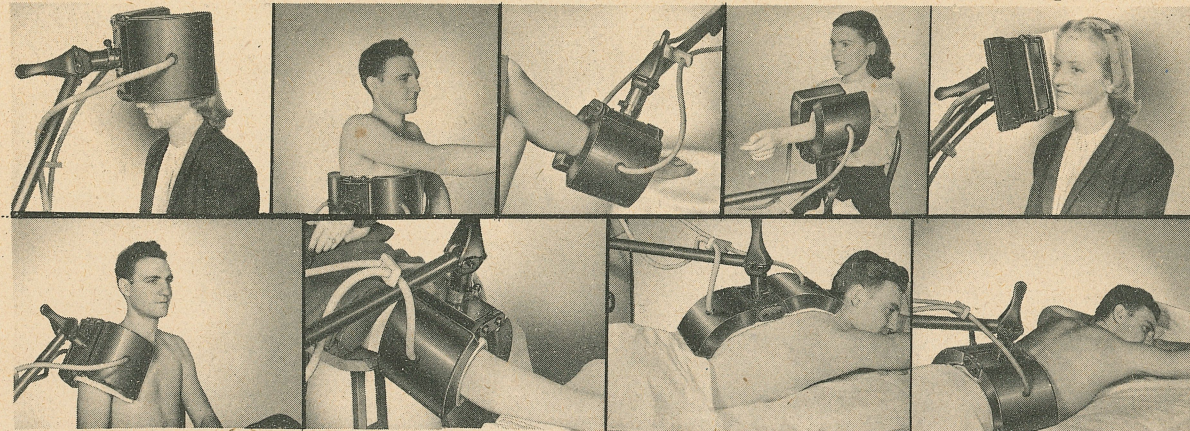
Proper spacing is provided within the Drum and to space it away from the patient will make the treatment less effective and will cause the bakelite cover to become heated. To reduce the power to patient, use the Power Control -- do not space Drum away from the part to reduce the heat.

When the Drum has been properly positioned, be sure to separate the leads so that they are spaced well away from each other, from the back of the Drum and from any other conductive material. Use the Drum Leads Clamp to hold the leads properly during treatment. (See pg. 5).

See Page 15 for procedure to be used in giving treatments.



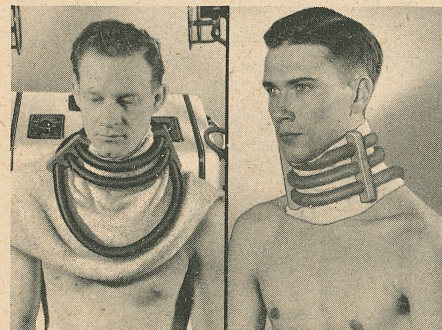
EXAMPLES OF HINGED TREATMENT DRUM APPLICATIONS



INDUCTANCE CABLE METHOD  
 Of Applying Diathermy Treatments

Since the advent of the more convenient Hinged Treatment Drum, the Inductance Cable is not used as extensively as before, but it is still useful for certain applications such as "wrap-around" treatments to neck and bronchi, and occasional "pancake coil" treatments. In "wrap-around" applications to the extremities, be sure to make even turns of the cable and by so doing avoid "hot spots".

EXAMPLES OF CABLE APPLICATIONS



When applying the Cable for treatment, always use a towel next to the skin to absorb perspiration -- and use from 1/2 inch to 1 inch spacing. A turkish towel is ideal, both for spacing and absorption of perspiration when using the Inductance Cable.

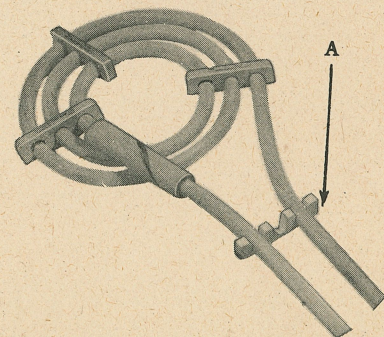
Whether used in "pancake" or "wrap-around" form, the turns of the Cable should be held in place by the Cable Retainer Clips. Always use the Rubber Separator for insulation where the

Cable crosses the turns of the "pancake coil". (See below.)

At the right is illustrated a "pancake" Cable with Retaining Clips and Rubber Separator Guard in place. Notice, that the correct method of using the Cable Clips to hold the two leads together is to allow one groove of space between them.

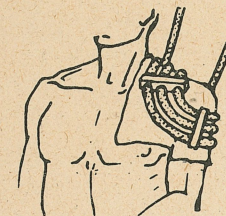
It is possible to make certain arrangements of the cable which cannot be "tuned in" satisfactorily with the Resonance Control. If this happens, a slight re-arrangement of the turns and leads will eliminate the difficulty.

See page 15 for procedure to be used in giving treatments.



Showing correct use of clip at A.  
 (Cable pressed into outside grooves.)

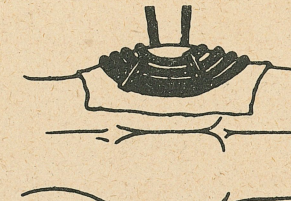
OTHER EXAMPLES OF INDUCTANCE CABLE APPLICATIONS



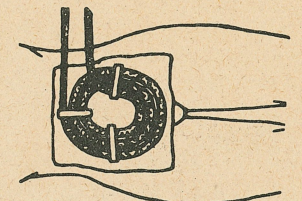
Shoulder



Chest

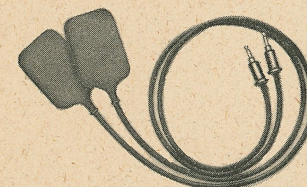


Hip



Pelvis

PAD METHOD  
 Of Applying Diathermy Treatments

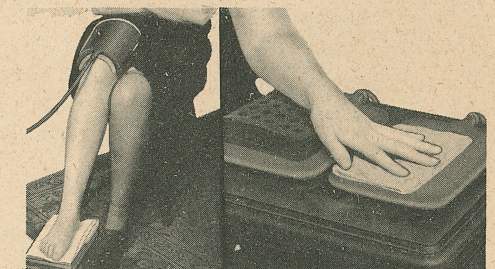


Condenser Pads

The Pads operate on exactly the same principle as the Air-Spaced Plates (see page 4) except that the Pads are not supported by the Adjustable Counterbalanced Arms and are spaced away from the patient by toweling or felt spacers. They may be used in combination with Plates, if desired, i.e., one Pad and one Plate plugged into opposite terminals.

It is quite important, in arranging Pads, that both pads be placed on the patient as symmetrically as possible, using same spacing under each Pad unless localization of heat is desired. Ordinarily, one or two felt spacers (or equivalent) should be used under each pad but heating can be concentrated by using less spacing under one and more under the other. Always use one layer of toweling or Kleenex next to the skin to absorb perspiration. Do not place felt spacers directly against the skin.

Never allow the leads to contact patient or other conductive objects and arrange them so that they do not touch or cross each other. It is also best not to rest one or both Pads directly on floor, chair, table or couch -- use some non-conducting separation to avoid loss of power to such object.



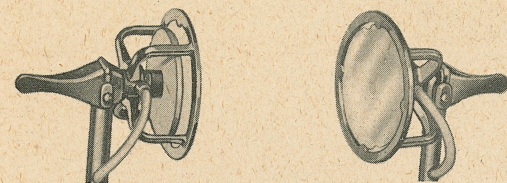
Examples of Pad Application

The Pads may be held in position, when necessary, by light but secure bandaging with the rubber bandages furnished with the machine. The Pads are heavy enough to support themselves for most applications and can be flexed to fit the contour of the part, which also assists in keeping them in position.

See page 15 for procedure to be used in giving treatments.



AIR-SPACED PLATE METHOD  
 Of Applying Diathermy Treatments



L-F Air Spaced Plates and Guards

The Air-Spaced Plates afford one of the most convenient and effective methods of administering Diathermy Treatments. Towels are practically eliminated with this method of treatment because in a majority of cases, the patient is not contacted. The Air-Spaced Plates are particularly effective in the "long-path" treatments; namely, hip to foot, and shoulder to hand. They are also effective for treatments around the head; i.e., sinuses, ears, etc.

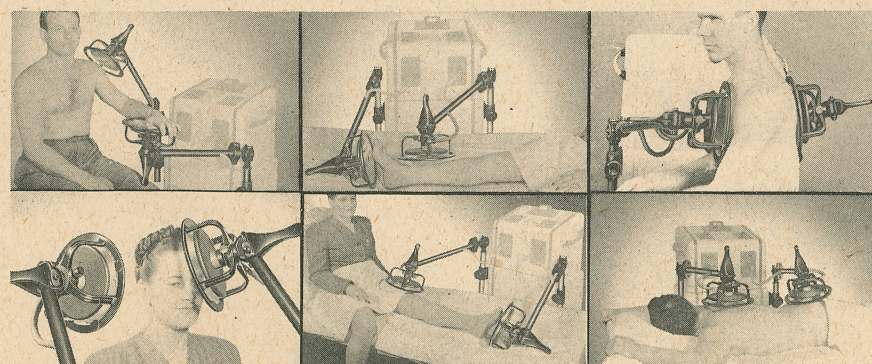
For most efficient operation, the total spacing used under both plates should not be more than 2". This spacing can be divided unequally for the purpose of localizing heat. For example, there might be 1/2 inch spacing under one plate and 1-1/2 inches under the other. The greater heat will be produced under the plate closer to the body. The closer the plates are adjusted to the patient, the more skin heat will be felt; when they are farther away, the energy spreads out and less heat is felt.

The use of the Plate Guards helps to maintain the desired spacing and increased operating stability of the machine. They may be used with or without the removable transparent Discs and the Guards, themselves, are easily removable for attachment of Treatment Drum or if treatment is to be given without them.

The Counterbalanced Adjustable Arms, which support the Air-Spaced Plates, are designed to permit placement in any desirable treatment position by merely grasping the handle and placing the applicator as wanted. Once placed, these counterbalanced and frictioned Arms will hold their position without any further manipulations. When not in use, the Arms may be swiveled around to the sides of the machine, out of the way, with the terminal plugs inserted into receptacles provided for them in the rubber bumpers attached to the arms.

The Air-Spaced Plates are inserted in snap terminals in end of handle cross-piece. If Plate Guards are to be used, they are placed in position before the plates are attached.

EXAMPLES OF AIR-SPACED PLATE APPLICATIONS



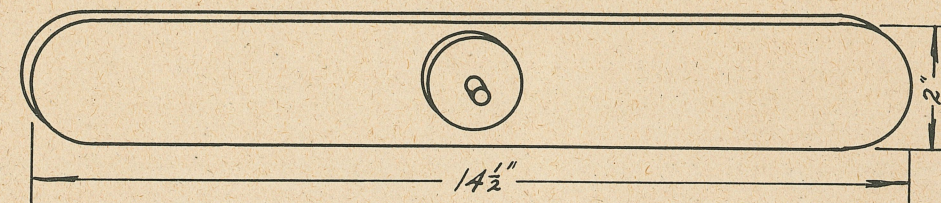
(See page 15 for procedure to be used in giving treatments.)

The connecting cords from the Chuck Handle and the inactive Pad electrode should be kept as far apart as possible.

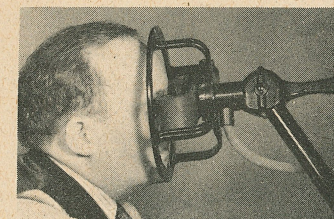
When using the unit for electrosurgery, remember that you are working in the presence of electrical sparks which may ignite inflammable cleansing liquids, solvents or explosive gases. Allow time for complete evaporation of alcohol or other inflammable fluids before applying the current and do not use ethylene, cyclopropane, open ether or other dangerously explosive anaesthetics.

AIR-SPACED UTILITY APPLICATOR

A Special Applicator Available as an Extra to Standard Accessories



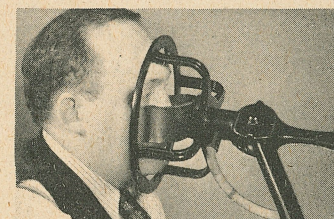
An effective applicator for localizing therapeutic heat over small areas and for application to neck, axilla and joints, as shown on following page. Particularly useful to Otolaryngologists.



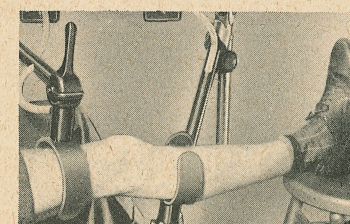
Treating Eyes



Shape of Applicator



Treating Antra



Treating Knee

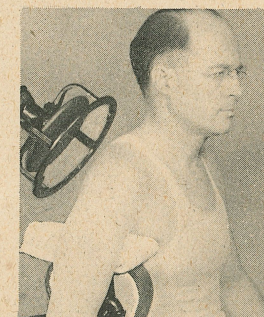
When treating the eyes or antra, the Plate Guard is used for stabilization of the head. The chin rests against the lower edge of the guard when applicator is positioned over eyes; against the patient's forehead when treating the antra. (Allow about 1/2" spacing.) To treat one eye or one antrum, bend the applicator away from the side not to be treated.



Treating Neck



Shape of Applicator



Treating Axilla



Shape of Applicator

For treating the throat, bend applicator into a "U" shape as illustrated. Use 1/2" to 1" of towel spacing which may, if desired, be attached to applicator by rubber bands. To treat axillary abscess, the Utility Applicator is bent backward to form an inverted "U". This is a practical and convenient application, permitting concentration of energy exactly where needed. Spacing of 1/2" to 1" is suggested.

In each treatment the dispersive plate is spaced about 2" away from the patient's back.



SECTION VII  
GENERAL PRECAUTIONS

CAUTION

This machine is sold only for use by or under the direction of a qualified physician. The observance of safe and established medical practice is essential to its proper use; otherwise, there are possibilities of injuries to patients or operator.

For Protection of Patient and Operator:

1. Be sure that metal cabinet is properly grounded in accordance with grounding instructions furnished. Shock to patient or operator is otherwise possible.
2. To avoid skin burns, always use ample spacing between treatment applicators and patient's skin, keep applicator leads well away from contact with patient and maintain treatment heat below patient's tolerance at all times. (Heat insensitive patients should not be treated. Determine heat sensitivity with each patient in advance of treatment.)
3. Metal heats rapidly and intensively in the presence of radio frequency energy and to avoid burns from this source, all metal objects on patient's person must be removed from the field or vicinity of the applicators. (Look for and remove hair pins, lingerie buckles, pins, garter buckles, necklaces, charms, watches, chains, corsets with metal stays, spectacles, earrings, collar buttons, tie clasps, etc., and be careful about treatment of patients with history of orthopedic surgery.)
4. Warn patients against touching leads or applicators during treatment and be careful that applicator does not slip off spacing material during treatment and contact the skin.
5. Kapok filled cushions, "inner spring" mattresses and keratol (imitation leather) table tops and pads have been known to heat to the burning point from contact with short wave applicators and it is important to keep applicators or leads at least 4" away from all such articles.
6. After treatment of any duration, a "cooling off" period should be allowed before dismissing the patient from your office (especially in cold weather).
7. When using the unit for electro-surgery, remember that you are working in the presence of electrical sparks which may ignite inflammable cleansing liquids, solvents or explosive gases. Allow time for complete evaporation of alcohol or other inflammable fluids before applying the current and do not use ethylene, cyclopropane, open ether or other dangerously explosive anaesthetics.

For Protection of Machine and Applicators:

1. Be sure that plugs are pushed all the way in and that they are connected to the proper terminals for the applicator being used.
2. When pulling plugs out of terminals, grasp the plug, not the cord.
3. Always use an individual outlet. Do not connect machine to same outlet with other appliances.
4. Always separate applicators at least four inches from metal table, metal objects, cabinet of machine, inner spring mattresses or keratol covered pads or cushions. Do not cross applicator leads or allow them to come in contact with metal. (See use of Drum Lead Clamp Pg. 5).
5. Avoid breakage of Treatment Drums by careful handling and do not tighten holding screws excessively.

SECTION VIII  
SERVICE NOTES

TUBES: It is to be expected that after prolonged use, the vacuum tube will run out its normal life cycle and will need replacing. A new tube should be ordered direct from Company or through the dealer who supplied the machine. Tubes supplied by us are tested thoroughly for maximum electro-therapeutic service. This insures your getting proper tubes from which best results can be obtained.

As a rule, the tube does not burn out -- there will simply be noted a gradual decrease in the current output of the machine. Continue to use the tube until the output falls below a satisfactory therapeutic value. In ordering a new tube, be sure to give serial number of your machine, as several types of tubes are in use, and you must have the proper tube for your particular unit.

Continued blowing of fuses or persistent buzzing of the Protect-A-Tube may indicate that the oscillator tube is "gassy" and should be replaced. Reorder from The Liebel-Flarsheim Company.

A "defective" tube should be returned for inspection in same container in which replacement tube is received. Tubes proving defective in service within the guarantee period will be adjusted, based on the use they have provided.

REPLACING PILOT LIGHT: Should pilot burn out, a new one may be inserted by removing back panel, making sure the supply cable first is disconnected. The pilot lamp socket can be dropped down by pulling socket from friction clamp. Remove bulb from socket, replace, and put socket firmly back into position.

APPLICATORS: As all rubber deteriorates somewhat under the influence of heat, it will be necessary to replace the rubber covered electrodes after long use. This will occur only after a long time, but should be looked out for. Long exposure to the rays of the sun or an ultra-violet lamp also deteriorates the rubber. If the rubber develops cracks, becomes "spongy" or brittle, this indicates that replacements are in order.

ALWAYS GIVE SERIAL NUMBER OF MACHINE  
WHEN WRITING FOR INFORMATION OR REPLACEMENT PARTS.

**THE LIEBEL-FLARSHEIM CO.**  
**303 W. THIRD ST., CINCINNATI 2, OHIO**







UE 468 J50  
United Electronics

D-101

# INSTRUCTIONS

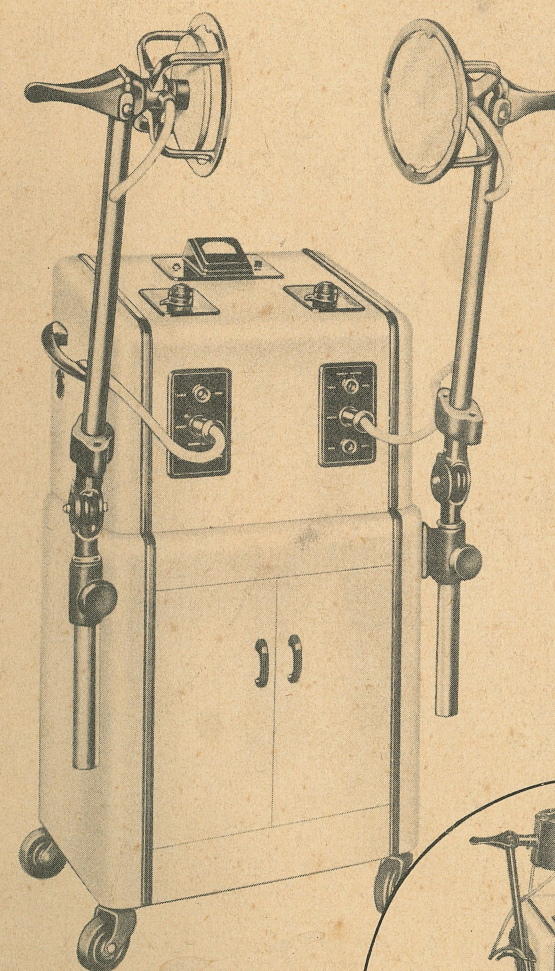
FOR SETTING UP AND OPERATING THE



## SW-227

*Frequency-Controlled*

## SHORT-WAVE DIATHERMY



**F.C.C. TYPE APPROVAL**  
**No. D-472**

**✓** Canadian  
Div. of Transport  
Approval No. 4

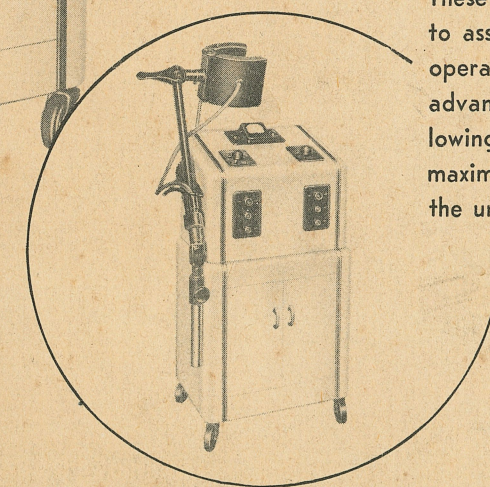


Accepted  
AMA  
Council on Physical  
Medicine



Approved,  
Underwriters'  
Laboratories

These instructions have been prepared to assist you in the safe and efficient operation of your machine. It is to your advantage to study them carefully, following suggestions as given, so that maximum satisfaction is obtained from the unit.



*The* **LIEBEL**  **FLARSHEIM Co.**

CINCINNATI 2, OHIO



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## — SECTION I —

### PRELIMINARY INFORMATION

Diathermy is the art of producing heat within body tissues by passing a high frequency electrical current through the part. Because of the very high frequencies employed, there is no muscular or nervous reaction. The heat results from resistance offered by the tissue to the passage of the electrical current.

Modern short wave diathermy machines, employing radio frequency (millions of cycles per second) are capable of inducing electric currents within the tissue without the necessity of metallic contact with the skin. Thus, insulated applicators are used and spaced away from the skin to promote safety, comfort and convenience.

Short wave diathermy induces these currents in either of two ways:

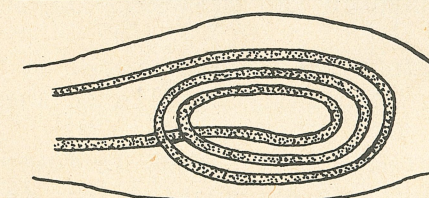
- With magnetic induction electrodes (using inductance cable or Treatment Drum)
- With condenser (capacitative) electrodes (using pads or Spaced Plates)

The L-F Model SW-227 Short-Wave Diathermy Unit provides currents for both Magnetic Induction Electrodes and Condenser Electrodes and is, therefore, capable of operating all types of applicators.

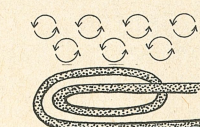
### Magnetic Induction Electrodes.

In this type of application, a continuous conductor is used (usually formed into a coil) -- i.e., Inductance Cable or Treatment Drum. When high frequency alternating current flows through this conductor, an intense magnetic field surrounds it. The magnetic field builds up and collapses several million times per second and as it so fluctuates, the magnetic lines of force in the field are moved with great speed. When a body part (or any other conductor) is brought within this moving magnetic field, circulating electric currents (eddy currents) are induced in the conductive material, and a rise in temperature results. No current enters the body directly from the electrode or leaves the body to the electrode.

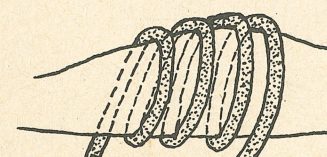
### DIAGRAMMATIC EXPLANATION OF ENERGY DISTRIBUTION WITH CABLE OR DRUM



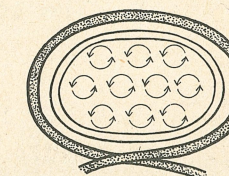
"Pancake Coil" or Treatment Drum.



Showing eddy current effect in conductive tissue.



Cable wrapped around tissue mass. Showing eddy currents in tissue surrounded by cable.





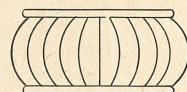
### Condenser Electrodes (Capacitative).

The "Condenser" Electrodes draw their name from the fact that when a pad (or Spaced Plate) is placed adjacent to a body part; the electrode surface - the air space (or spacer material) - and the surface of the body next to the electrode, form a Radio Frequency Condenser.

When a body part is placed between two such electrodes, it is actually in the High Frequency Circuit of the machine and current will flow through the body part from "one electrode to the other".

The condenser type applicators are applied opposite to each other or in the same plane. Variations in spacing and placement permit concentration or dispersion of heating, as desired.

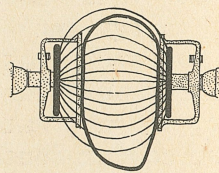
#### DIAGRAMMATIC EXPLANATION OF ENERGY DISTRIBUTION WITH PADS OR SPACED PLATES



Schematic representation of current flow between two opposite pads.



Current flow between two pads in same plane.



Concentrating energy by different spacings. More heat is produced at closer application.

## SECTION II

### SETTING UP AND PREPARING MACHINE FOR USE

The Complete SW-227 is packed in three cases as follows:

- 1 - Corrugated Carton containing the Unit Proper.
- 1 - Large Corrugated Carton containing Sub-Cabinet and Counterbalanced Supporting Arm (or Arms). All applicators, including Hinged Treatment Drum and Drum Lead Clamp, (Spaced Plates, Guards and Transparent Discs - when ordered) are packed in the cupboard compartment of the Sub-Cabinet.
- 1 - Special Corrugated Tube Carton containing oscillator tube, if unit is shipped West of Rocky Mountains, otherwise oscillator tube is shipped in place.

Inspect all cartons for damage caused by shippers. If damage is found; immediately call the Shipper's Claim Agent. Preserve all packing for inspection by the Claim Agent. The customer should file the claim.

#### Assembly

Unpack large corrugated carton containing Sub-Cabinet and accessories. Note that the Counterbalanced Arm (or two arms if machine is so ordered) is packed in a separate carton slipped into the inside front cover of the large carton.

Open the corrugated carton, and lift away top brace that holds unit down in case. Lift out the machine and set it on top of the Sub-Cabinet. Secure the machine to the Sub-Cabinet by means of two thumb screws supplied in an instruction envelope packed in the Sub-Cabinet.

Install Arm or Arms in brackets on Sub-Cabinet. To attach the Hinged Treatment Drum to the Arm (or either Spaced-Plate Arm); loosen the thumb screw on the Hinged Drum metal clamp; slide the opening in the clamp over the square boss on the side of the arm head; turn the clamp 1/8th turn to lock it in position and tighten the clamp with the thumb screw.

### The Drum Lead Clamp

The Drum Lead Clamp is provided as a means of keeping the Drum Leads separated and to prevent their touching the back of the Drum or any other conductive parts during the treatment. If the leads are allowed to touch; the rubber insulation will heat, melt, or burn, depending on the severity and duration of the contact.

The Drum Lead Clamp should be installed on the arm holding the Hinged Treatment Drum in the manner shown in the illustration (Fig. 2). Follow mounting instructions appearing on the tag accompanying the clamp.

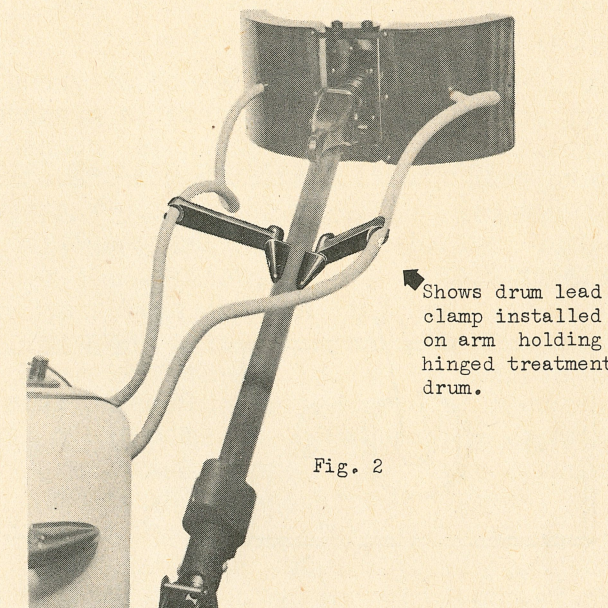
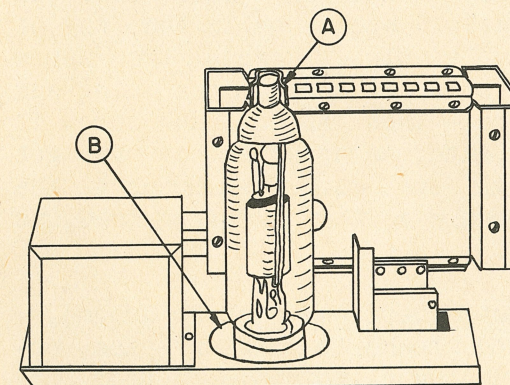


Fig. 2

### Installation of Tube



Place tube in socket (B). The pins in tube fit slots in socket. Push tube down and turn 1/8 turn clockwise. Press connection clip onto plate terminal at top of tube at (A). Replace back before plugging in supply line.

Be sure Supply Line Cable is disconnected.

Remove all of the sheet metal screws and lay aside the back panel.

The Oscillator Tube is packed in a special carton of its own. Unpack it carefully and install in the machine, following the illustrated instructions at left. Handle tube with care.

When tube has been installed, replace the back with nameplate upright and replace all of the sheet metal screws. Reconnect the line cable to its receptacle on the cabinet.

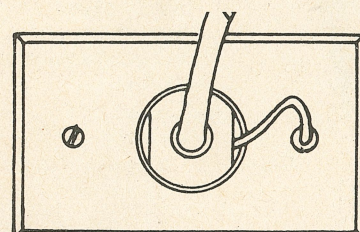


### Instructions for Grounding Cabinet.

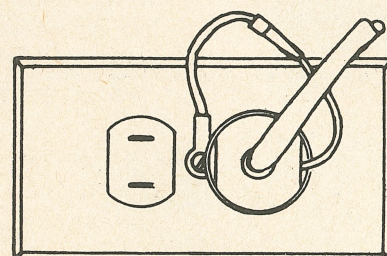
It is accepted practice to ground all electrical apparatus housed in metal cabinets. Accordingly, the necessary wires and screws for grounding the apparatus to a grounded wall base outlet, are included with the SW-227. These will be found in an envelope in the storage compartment of the machine.

Because most modern wall box receptacles are grounded, a good ground can usually be had by connecting the green lead on the male end of the supply cable directly to the receptacle box cover (see example one and two below). However, in some instances, it may be necessary to connect to a radiator, steam line or water pipe to be sure of a proper ground (see example three below).

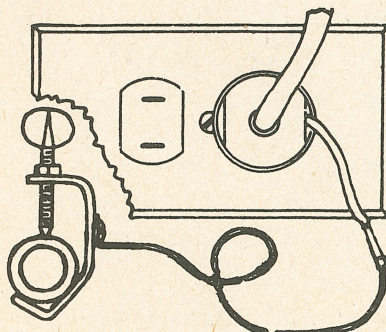
To be sure about which method of grounding to use, determine first whether or not your wall box receptacle is grounded. Remove the cover and see if a metal pipe or "BX" flexible cable is connected to the outlet box. If so, you may make your ground connection to the box as in example one or two. If not, or if you are unable to determine whether the wall box is grounded, use method under example three -- or consult building superintendents, architect or electrician.



No. 1 - Single Outlet Receptacle with Ground.



No. 2 - Double Outlet Receptacle with Ground.



No. 3 - Outlet Receptacle without Ground.

#### Example 1. Single Receptacle with Ground.

Remove one of the screws from the outlet plate. Replace this screw with the threaded end-piece from the green grounding lead. This end-piece can be pulled off the green lead for the purpose of screwing it into the wall plate. Then, push the sleeve back over the end-piece and the cable is grounded.

#### Example 2. Double Receptacle with Ground.

On this type of receptacle, it will be necessary to use the short grounding wire included with grounding accessories, because the screw only (as used with single outlet) would be in the way of plugging in the supply plug. Remove the screw from the plate and slip it through the ring end of the grounding wire - then replace and screw it tightly to the wall plate, being sure that you get a good metal-to-metal contact. Then connect the other end of the short wire to the green lead, as illustrated.

#### Example 3. Outlet Receptacle without Ground.

If it is necessary to ground to a water pipe, obtain a suitable grounding clamp and wire from the Building Superintendent, a local electrician or a hardware store. Be sure that the grounding clamp makes good metallic contact. The clamp type illustrated is preferred. Fasten the clamp securely to cold water pipe if possible -- making sure that point of clamp pierces through any paint and into metal. Connect clamp to green lead of supply cable by a suitable length of wire.

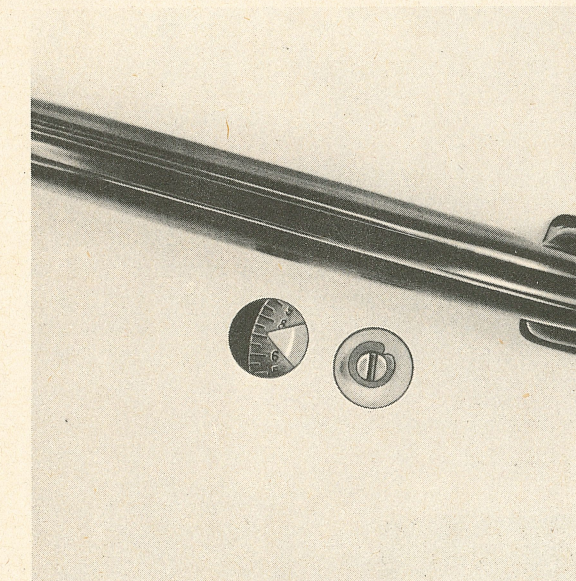
### Connection to Power Supply.

Unless otherwise specified on nameplate, this machine is for operation on Alternating Current of 105 to 125 volts, 60 cycles. BE SURE SUPPLY MATCHES RATING OF THE MACHINE SHOWN ON NAMEPLATE. If only D.C. current is available, a rotary converter of 13 amperes capacity, supplying 115 volts, 60 cycles, A.C. is required.

After you have made sure that power supply is correct for this machine; plug female plug of line cable into male receptacle on side of machine; plug male plug of line cable into appropriate female receptacle of power supply (usually a wall base outlet).

Before energizing the machine, be sure you have read Section III and IV of these Instructions. Then energize the unit, adjust "Trimmer" to frequency and machine will be ready for use.

### Method of adjusting the "Trimmer" to set machine on Proper Frequency.



"Trimmer" Control

The "Trimmer" Control is accessible through two holes on the left side of the cabinet, under the handle and just ahead of the line voltage adjustment switch. Remove the two caps covering these holes by sliding a flat blade under the edge of each one and prying out. One opening exposes a dial and pointer. The other reveals a slot in the end of the Trimmer adjustment shaft. This slot will receive the edge of a dime if a screw driver is not handy. The object of the Trimmer Control is to set the basic frequency of the oscillator at the exact center of the frequency band allocated by F.C.C. This is explained in Section III.

On installation of this unit or after any change of a circuit component such as an oscillator tube, the frequency of the oscillator should be adjusted to the exact center of the allowable radio frequency band. This procedure is as follows:

1. Be sure back panel is in place and fastened with screws.
2. Disconnect all applicators.
3. Plug in the Supply Cable.
4. Turn Resonance Control completely to right (clockwise).
5. Turn Main Switch (Power Control) to "Hold" position and leave for 5 seconds.
6. With Power Control in "Hold" Position, check and adjust line voltage.
7. Turn Power Control to Setting "1" and wait 3 minutes.

If buzzer operates when machine is first turned to Setting "1", the Trimmer is probably set outside of the allowable band limit. Turn the Trimmer Dial 2 divi-



sions at a time (returning the Power Control to Hold position and then back to Setting "2" after each change of dial position) until unit will operate (no buzzing); then proceed as per step 8.

8. Insert a screw drive (or dime) in slot of Trimmer adjustment shaft and turn slowly clockwise to reduce numbers until buzzer sounds. (Wavemaster operates, indicating lower limit of band.)
9. Note and record Trimmer Dial setting at point where buzzer first sounds.
10. Advance Trimmer Dial (counterclockwise) two divisions.
11. Return Power Control to "Hold" position to stop buzzer. (This resets the Wavemaster circuit.)
12. Again advance Power Control to Setting "2".
13. Advance Trimmer adjustment shaft slowly counterclockwise to increase numbers until buzzer sounds again (Wavemaster operates, indicating the upper limit of band.)
14. Note and record Trimmer Dial setting at point where buzzer starts to sound.
15. Turn Power Control to "Off" position.
16. Set Trimmer Dial halfway between band limits recorded in steps 8 and 13.

Example: If lower limit is 4 and upper limit is 11, set Trimmer Dial at half-way point -- which, in this case, would be 7-1/2.

Note: In rare cases, a particular oscillator tube may cause the unit to shift frequency so that one or the other band limit lies beyond one extreme of the Trimmer Dial. This is of little consequence. Find upper or lower band limit and set the Trimmer Dial 2-3/4 division below or above it (as the case may be) so that buzzer does not sound.

### — SECTION III —

#### TECHNICAL CHARACTERISTICS

##### General

The Liebel-Flarsheim SW-227 FREQUENCY-CONTROLLED Short-Wave Diathermy Unit employs a single (type - 468) oscillator tube in a self-rectified, self excited oscillator circuit. The SW-227 is not a crystal-controlled machine. Its frequency stability is inherent in its design; and frequency shift is effectively controlled by an electronic device - The L-F Wavemaster.

The oscillator circuit and all necessary controls are contained within a ventilated all metal cabinet that is mounted on top of a matching sub-cabinet, which provides a mounting for the adjustable arm (or arms) and storage space for applicators and accessories.

##### 1. Frequency

The Model SW-227 operates within the 27 megacycle channel allocated by the Federal Communications Commission for use by this type of equipment. The wave length is approximately 11 meters.

##### 2. Method of holding frequency within allocated channel.

The SW-227 oscillator circuit incorporates an original L-F electronic device known as the "Wavemaster". The L-F Wavemaster prevents operation outside of the Specific Radio Frequency Band allocated by the Federal Communications Commission. The Wavemaster continually monitors the upper and lower limits of the 27 megacycle channel. It allows the SW-227 to operate with complete freedom within the limits of the channel, but if the machine should, for any reason, approach either band limit, the Wavemaster immediately reduces the power to zero and sounds a warning buzzer. This protective device guarantees the user that his machine can never operate except on proper frequency.

##### 3. Method of setting oscillator on fundamental frequency.

A primary frequency adjustment device or "Trimmer" is incorporated in the circuit; and has "screw driver" adjustment control accessible through the side of the machine. This "Trimmer" affords adjustment to set the nominal frequency of the oscillator at the exact center of the band. (For complete instructions on method of adjustment, see Section II). This adjustment need be done only on installation of the unit, and after repairs or tube replacement.

##### 4. Applicators operate at Resonance.

Unlike prior short-wave Diathermy equipment, the Model SW-227 is designed to operate all applicators at resonance. Heat production is thus more efficient; but more important is the fact that when applicators are critically tuned, any movement on the part of the patient will de-tune the circuit and reduce power. This removes the danger, that movement on the part of the patient might increase the power beyond patient tolerance, as is the case with many other Short-Wave Diathermies.

##### 5. Power Output.

The SW-227 is rated at approximately 300 watts output. This is ample for even heaviest treatments because of the unusual efficiency of operation, due to the fact that the circuit is adjusted to resonance for all loads. Control of the power is smooth, simple and precise.

##### 6. Protective Devices.

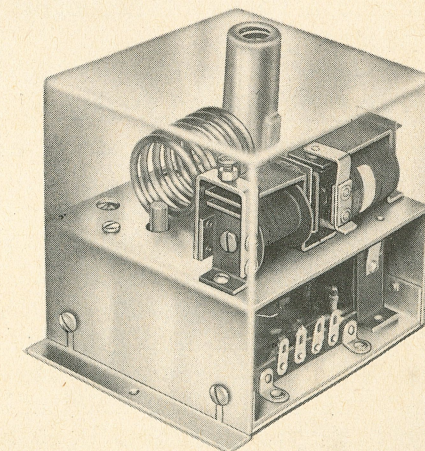
###### (a) The Protect-A-Tube

The SW-227 incorporates the Patented L-F Protect-A-Tube which automatically reduces the power and sounds a warning buzzer whenever some unusual condition threatens to create an overload of tubes or circuit.

###### (b) The Wavemaster

The L-F Wavemaster automatically reduces the power to zero and sounds a warning buzzer whenever any unusual condition alters the frequency of the oscillator so that it threatens to shift outside the allowable frequency limits.

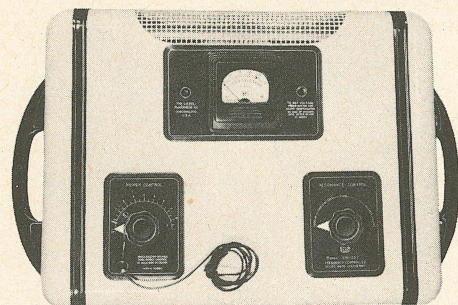
These two circuits are contained within a sealed metal box, with plug in electrical connections, located in the rear of the oscillator cabinet.





## — SECTION IV —

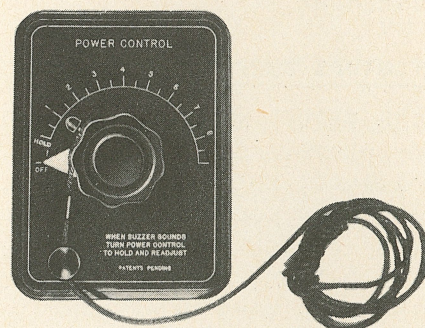
### DESCRIPTION OF CONTROLS



All operator's controls, with exception of the line voltage compensator, are located on the slanted-top panel of the unit. (See illustration at left.)

#### Power Control.

This control, located on the left-hand side of the slanted-top panel, combines the On-Off switch with a "filament on" station marked "Hold" and a Power Control scale with arbitrary calibration "1-9". When the control is turned from Off to "Hold", the filament of the oscillator tube and the pilot lamp is lighted. The control should be left in "Hold" position approximately 5 seconds before advancing into Power Control range. If operator does not wait until filament has heated, the Protect-A-Tube will operate and it will be necessary to return to "Hold" position for two or three seconds before again advancing to Power Control range. At the end of each treatment, this control should be turned to "Off" position.

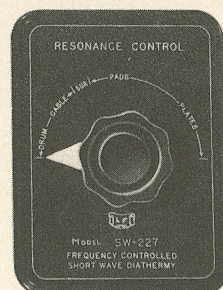


Power Control

A "Patient Pull-Off Cord" is attached to this control to allow the patient a means of reducing the heat or turning machine off if he is left unattended.

#### Vernier Resonance Control.

On the right-hand side of the slanted-top panel is the Resonance Control which provides a means for "tuning" each treatment application for maximum efficiency. This control incorporates a Vernier Mechanism to allow accurate adjustment to Resonance with ease. In operation, the Resonance Control is first turned to the general position indicated for the type of applicator used; i.e., left portion of the dial for Hinged Drum or Cable; right portion of the dial for Pads and Spaced Plates. An Orificial applicator will tune similar to a "Pad". (See page 22 for special instructions for Surgery.)



Resonance Control

To start a treatment, the main switch is turned to "Hold" for five seconds; then to the mid-range of the Power Control Dial. Thereafter, the Resonance Control is carefully adjusted to produce the maximum obtainable reading on the meter. This is the point of resonance for the treatment load. The Power Control is then adjusted to obtain the desired heat, using the patient's tolerance as a guide.

This operation very closely resembles the procedure for operating a radio. The Resonance Control "tunes in" the treatment load almost exactly like a station is "tuned in" on a radio. The Power Control is then adjusted for "volume".

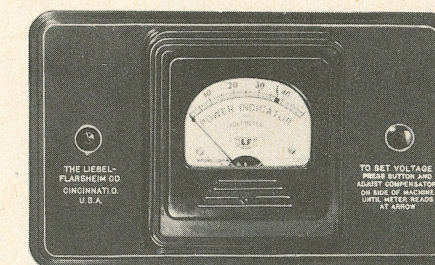
Important: When "tuning in" the SW-227, the operator should stand at least 12 inches away from the applicators or leads so that his body capacitance does not enter into the high frequency field -- causing false tuning which would change the meter reading as he steps away from the machine.

#### Power Indicator and Voltmeter.

The meter assembly, with pilot light and push button, is at the top center of the control panel. This meter performs two functions:

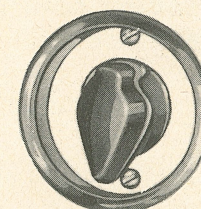
(a) Power Indicator - which gives a reliable relative indication of the amount of energy delivered to the patient.

(b) Voltmeter - When the push button (to the right) is depressed, the meter indicates the tube filament voltage, and should always read in the black section of the scale (37-39).



Power Indicator & Voltmeter

#### Line Voltage Compensator.

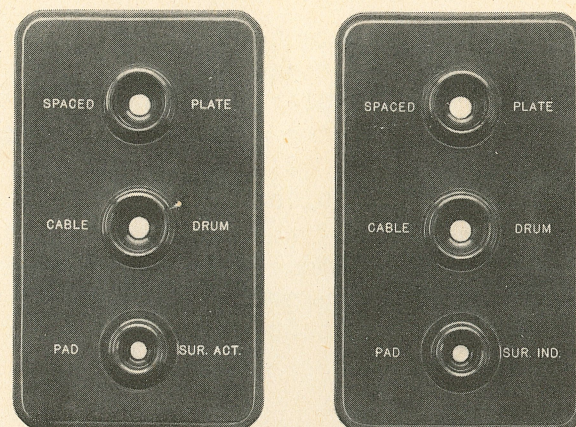


A Line Voltage Compensator is located on the left side of the unit, toward the rear of the cabinet. Line Voltage should be tested by depressing button to right of meter. If the meter does not read in the black section of the scale (with button depressed), the compensator switch should be turned until it does read in the black section. The Power Control should be in "Hold" position during this operation.



### Output Terminals

-are located on the front of the cabinet plainly marked for connection of the various applicators used with this machine. Connect to "Cable-Drum" terminals when using Inductance Cable or Hinged Treatment Drum. Connect to "Spaced Plates" terminals when using Air-Spaced Plates. Connect Pad applicators to "Pads" terminals. (See special instructions for Orificial Applicators, Pg. 21 and for Surgery, Pg. 22).



### Supply Line Connection.

At lower side of the upper cabinet is a male receptacle to receive the female plug of the supply cable.

## SECTION V

### PROCEDURE FOR ALL TREATMENTS

1. Be sure Power Control of Machine is in "Off" position.
2. See that both ends of supply cable are solidly connected to machine and to wall receptacle.
3. Position applicator or applicators to Patient, with desired spacing, making sure that Patient is in comfortable position to insure minimum movement.
4. Connect applicator lead plugs into proper outlet terminals on front of machine, pushing plugs all the way in. Be sure that applicator leads do not cross and that they are spaced well away from each other and from any conductive material.
5. Turn the Resonance Control to the section of its dial that is indicated for the particular applicator or applicators being used.
6. Turn Main Switch "Power Control" to "Hold" position and leave for approximately 5 seconds.
7. With Power Control in "Hold" position, depress button located to right of meter, to indicate line voltage. If the meter does not read in the black section of the scale (with button depressed), the line voltage compensator switch should be turned until it does read in the black section.
8. Advance Power Control to Dial Setting indicated below for applicator (or applicators) in use:

	Approx. Dial Setting
Cable, Hinged Treatment Drum or Orificial Applicator. . . . .	4-4½
Pads or Air-Spaced Plates . . . . .	5-6

9. While standing at least 12" away from the applicator (or applicators) and the applicator leads, adjust the Resonance Control slowly back and forth until you obtain a setting that produces the maximum meter reading. This procedure "tunes" the applicator (or applicators) to resonance for the treatment load and spacing. **(Pay particular attention to this step in the procedure. Tune slowly so that you can recognize "the maximum obtainable meter reading" for the Power Control setting.)**

As noted on Page 11, the operation of the SW-227 is very similar to operating a radio. The Resonance Control "tunes in" the treatment load -- the Power Control adjusts the "volume". Too much or too little "volume" makes "tuning" of your radio or your SW-227 inaccurate. You should, therefore, reduce or increase the Power Control settings recommended in step 8 to bring the meter reading within median range whenever the suggested settings produce too high or too low a meter reading for accurate "tuning".

10. Adjust the Power Control until the Patient feels a moderately warm sensation. While Patient's tolerance is the most reliable guide to dosage, also pay attention to meter reading, because treatments can thus be duplicated and experience will teach you to use the meter more and more as your guide.
11. Attend Patient closely for first few minutes because it will probably be necessary to reduce the power after heat builds up. To reduce heat, turn Power Control back (counterclockwise).
12. If you leave the Patient unattended, have him hold the Patient Pull-Off Cord, so he may reduce power or turn off the machine if he becomes uncomfortable or if Protect-A-Tube or Wavemaster operates (buzzer sounds).
13. If buzzer sounds during treatment, it means that something has happened to cause the Protect-A-Tube or Wavemaster to operate. To stop buzzing, turn main switch to "Hold" position. Then check applicator, retune and re-adjust power. (Steps 8, 9 and 10.)
14. If the Patient changes his position in relation to the applicator (or applicators) the output circuit will be de-tuned (reducing power) and the meter reading will drop. If it is not necessary to re-position the patient; merely retune the circuit with the Resonance Control and adjust Power Control to desired Meter reading. If it is necessary to re-position the Patient, first turn the Power Control to "Off" position, then repeat steps 6, 8, 9, and 10 to start the treatment again.
15. At end of treatment, turn Power Control to "Off" position before removing applicators from Patient or disconnecting them from the unit.
16. Allow Patient to "cool off" for about 30 minutes before going outside, particularly in cold weather.

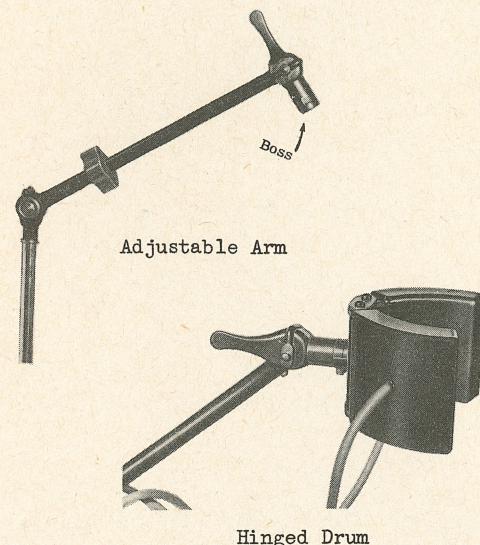


## — SECTION VI —

### TREATMENT APPLICATIONS

#### HINGED TREATMENT DRUM METHOD

##### Of Applying Diathermy Treatments



The Hinged Treatment Drum operates by the electro-magnetic induction principle, the same as the Inductance Cable. (See Page 3). This Drum applicator being hinged, fits any contour of the body; such as hip, shoulder, lower back, bronchial area and half chest. Treatments are easier, safer, and better -- with more comfort to the patient.

The Hinged Treatment Drum is standard equipment with the No. 2654 and 2656 combinations and, because of its adaptability, can be used for practically every induction type treatment.

The Hinged Treatment Drum contains two pancake coils which are interconnected. It is mounted on the Adjustable Supporting Arm which makes its placement extremely simple, speedy and convenient.

When attaching this Drum to the Supporting Arm, note that there is a small projection (or boss) at the side of the crosspiece where the Drum attaches. The open portion of the attachment clamp on the back of the Drum passes over this boss and the clamp is then slightly rotated before tightening so that the Drum will not fall off the arm even though the clamp should be loosened.

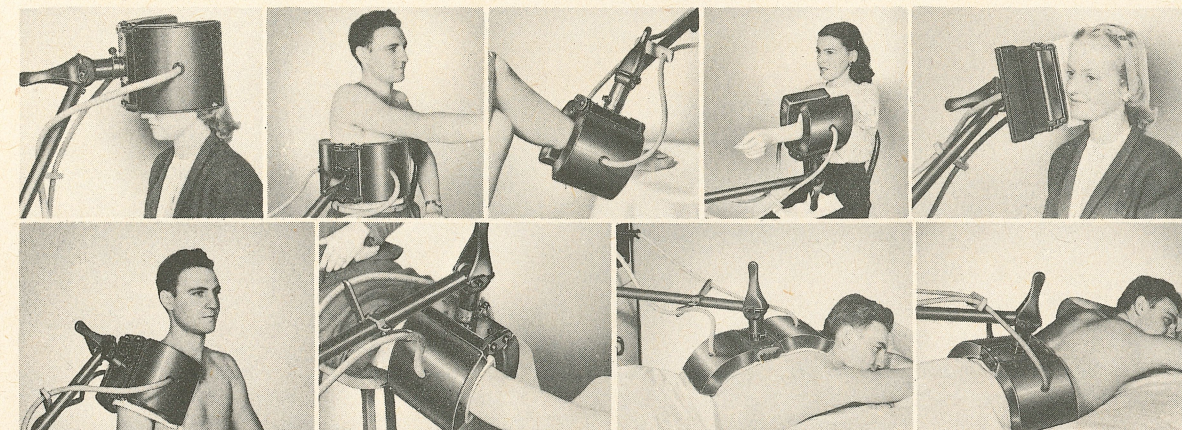
The Hinged Treatment Drum leads are connected to the "Cable-Drum" terminals of the machine. The Drum Lead Clamp should be mounted at about the center of the Counterbalanced Arm to allow uniform spacing between the Drum Leads.

The Hinged Drum is designed to be used against the part being treated, except that a layer of toweling or Kleenex should be placed between the drum and skin for sanitary reasons and to absorb perspiration.

Proper spacing is provided within the Drum and to space it away from the patient will make the treatment less effective and will cause the bakelite cover to become heated. To reduce the power to patient, use the Power Control -- do not space Drum away from the part to reduce the heat.

When the Drum has been properly positioned, be sure to separate the leads so that they are spaced well away from each other, from the back of the Drum and from any other conductive material. Use the Drum Lead Clamp to hold the leads properly during treatment. (See pg. 5).

#### EXAMPLES OF HINGED TREATMENT DRUM APPLICATIONS

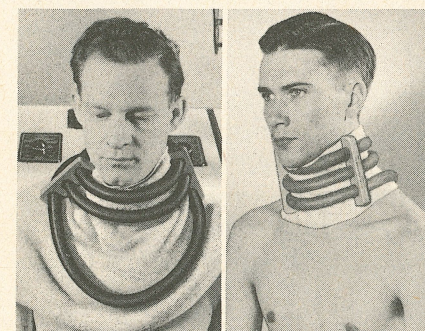


See page 12 for procedure to be used in giving treatments.

#### INDUCTANCE CABLE METHOD Of Applying Diathermy Treatments

Since the advent of the more convenient Hinged Treatment Drum, the Inductance Cable is not used as extensively as before, but it is still useful for certain applications such as "wrap-around" treatments to neck and bronchi, and occasional "pancake coil" treatments. In "wrap-around" applications to the extremities, be sure to make even turns of the cable and by so doing avoid "hot spots".

#### EXAMPLES OF CABLE APPLICATIONS



When applying the Cable for treatment, always use a towel next to the skin to absorb perspiration -- and use from 1/2 inch to 1 inch spacing. A turkish towel is ideal, both for spacing and absorption of perspiration when using the Inductance Cable.

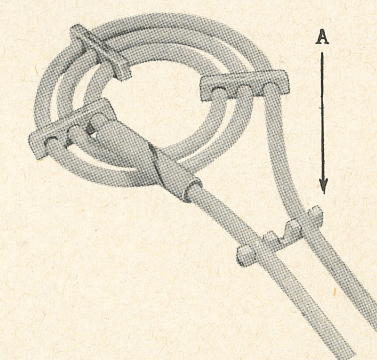
Whether used in "pancake" or "wrap-around" form, the turns of the Cable should be held in place by the Cable Retainer Clips. Always use the Rubber Separator for insulation where the

Cable crosses the turns of the "pancake coil". (See below.)

At the right is illustrated a "pancake" Cable with Retaining Clips and Rubber Separator Guard in place. Notice, that the correct method of using the Cable Clips to hold the two leads together is to allow one groove of space between them.

It is possible to make certain arrangements of the cable which cannot be "tuned in" satisfactorily with the Resonance Control. If this happens, a slight re-arrangement of the turns and leads will eliminate the difficulty.

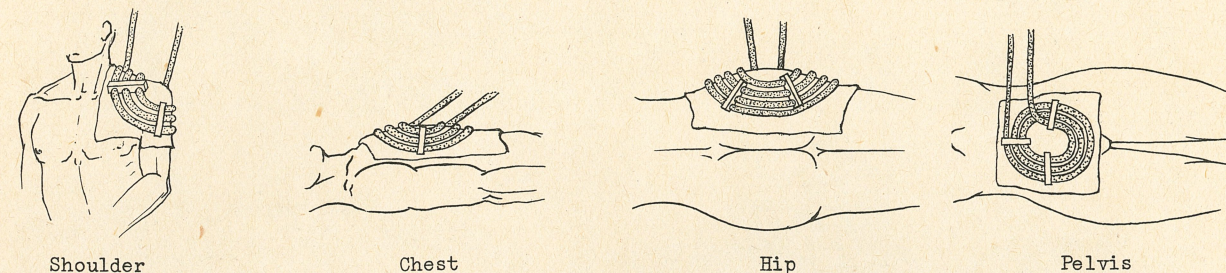
See page 12 for procedure to be used in giving treatments.



Showing correct use of clip at A.  
(Cable pressed into outside grooves.)

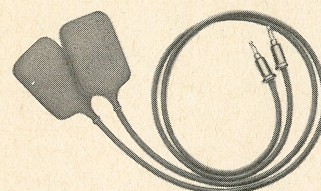


# OTHER EXAMPLES OF INDUCTANCE CABLE APPLICATIONS



## PAD METHOD

### Of Applying Diathermy Treatments.



Condenser Pads

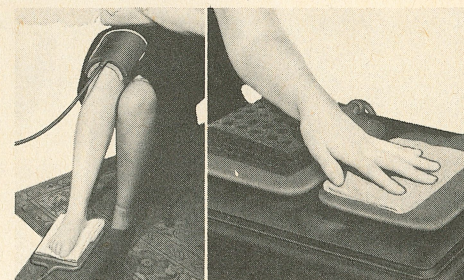
The Pads operate on exactly the same principle as the Air-Spaced Plates (see page 4) except that the Pads are not supported by the Adjustable Counterbalanced Arms and are spaced away from the patient by toweling or felt spacers. They may be used in combination with Plates, if desired, i.e., one Pad and one Plate plugged into opposite terminals.

It is quite important, in arranging Pads, that both Pads be placed on the patient as symmetrically as possible, using same spacing under each Pad unless localization of heat is desired. Ordinarily, one or two felt spacers (or equivalent) should be used under each pad, but heating can be concentrated by using less spacing under one and more under the other. Always use one layer of toweling or Kleenex next to the skin to absorb perspiration. Do not place felt spacers directly against the skin.

Never allow the leads to contact patient or other conductive objects and arrange them so that they do not touch or cross each other. It is also best not to rest one or both Pads directly on floor, chair, table or couch -- use some non-conducting separation to avoid loss of power to such subject.

The Pads may be held in position, when necessary, by light bandaging. The Pads are heavy enough to support themselves for most applications and can be flexed to fit the contour of the part, which also assists in keeping them in position.

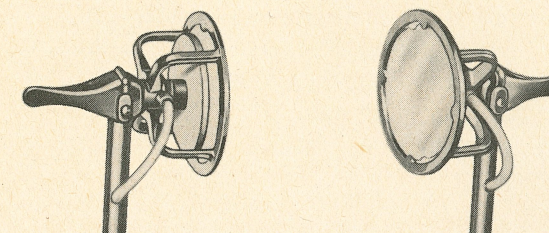
See page 12 for procedure to be used in giving treatments.



Examples of Pad Application

## AIR-SPACED PLATE METHOD

### Of Applying Diathermy Treatment



L-F Air-Spaced Plates and Guards

The Air-Spaced Plates afford one of the most convenient and effective methods of administering diathermy treatments. Towels are practically eliminated with this method of treatment because in a majority of cases, the patient is not contacted. The Air-Spaced Plates are particularly effective in the "long-path" treatments; namely, hip to foot, and shoulder to hand. They are also effective for treatments around the head; i.e., sinuses, ears, etc.

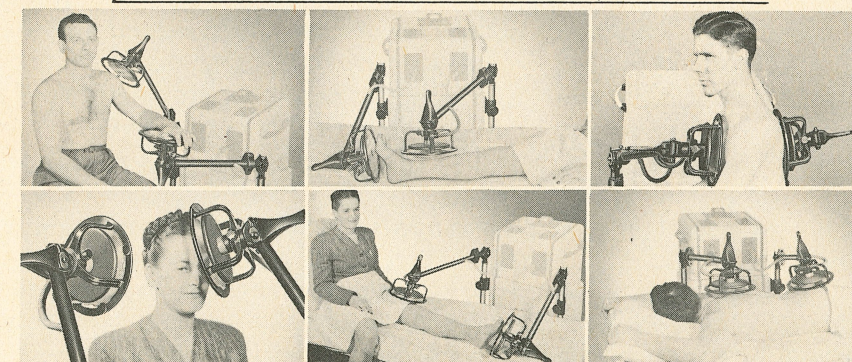
For most efficient operation, the total spacing used under both plates should not be more than 2". This spacing can be divided unequally for the purpose of localizing heat. For example, there might be 1/2 inch spacing under one plate and 1-1/2 inches under the other. The greater heat will be produced under the plate closer to the body. The closer the plates are adjusted to the patient, the more skin heat will be felt; when they are farther away, the energy spreads out and less heat is felt.

The use of the Plate Guards helps to maintain the desired spacing and increased operating stability of the machine. They may be used with or without the removable transparent Discs and the Guards, themselves, are easily removable for attachment of Treatment Drum or if treatment is to be given without them.

The Counterbalanced Adjustable Arms, which support the Air-Spaced Plates, are designed to permit placement in any desirable treatment position by merely grasping the handle and placing the applicator as wanted. Once placed, these counterbalanced and frictioned Arms will hold their position without any further manipulations. When not in use, the Arms may be swiveled around to the sides of the machine, out of the way, with the terminal plugs inserted into receptacles provided for them in the rubber bumpers attached to the arms.

The Air-Spaced Plates are inserted in snap terminals in end of handle cross-piece. If Plate Guards are to be used, they are placed in position before the plates are attached.

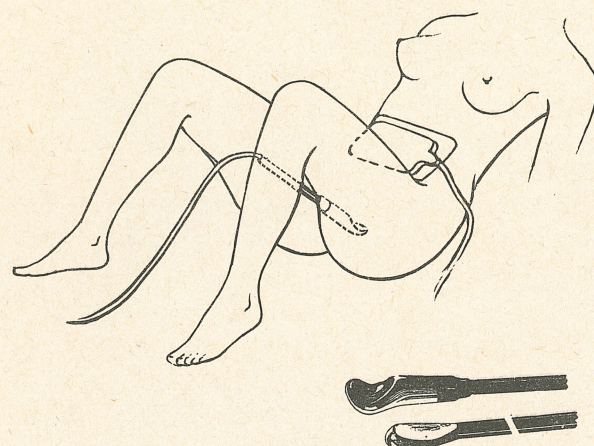
### EXAMPLES OF AIR-SPACED PLATE APPLICATIONS



(See page 12 for procedure to be used in giving treatments.)



# ORIFICIAL TREATMENTS



Many physicians prefer to give pelvic and prostatic treatments with orificial electrodes because therapeutic heat is thus more exactly localized than through the use of the Treatment Drum, Inductance Cable or Pad Applicators.

Such treatments are very satisfactorily handled with the Model SW-227, with precise control of the power to produce internal temperatures which will be therapeutically effective and comfortable to the patient.

The conventional metal-tipped prostatic and vaginal electrodes, such as were used with old-time long wave diathermy, are preferred for short wave diathermy treatments. They are safer and more satisfactory than any of the special type electrodes which have been designed particularly for short wave. The electrodes are available with thermometers so that constant temperature check can be maintained.

## TO GIVE AN ORIFICIAL TREATMENT

### Indifferent Electrode:

Use right hand (facing machine) Air-Spaced Plate or Pad as the indifferent electrode. If using the Air-Spaced Plate, plug it into the right hand Spaced Plate Terminal and space it 1 inch over the lower abdomen. When using the Pad as an indifferent electrode, plug it into the right hand Pad terminal (also marked "Surgery Inactive") and space it away about 1 inch over the lower abdomen.

### Active Electrode:

Insert Orificial Electrode, using K-Y Jelly as a lubricant. The thermometer is left in position in contact with the cervix throughout the treatment. Connect the Orificial Electrode, using the Orificial treatment connecting cord, to the left hand Pad terminal (also marked "Surgery Active").

For ordinary use, set the Power Control on 4. (See 8, pg. 15). Tune in the patient to resonance using the Resonance Control on the right-hand side of the control panel. Using the Power Control, reduce the output to a low setting at the start, gradually increasing as the treatment proceeds. Any indication of cramps denotes too much power has been used and current should be reduced. Temperatures of 108-110 degrees are easily obtained.

## EXAMPLE

### TEMPERATURE RECORD - PELVIC TREATMENT

Meter Reading	Temperature	Time in Minutes
25	104	5
30	106	10
35	108-1/2	20
40	109	30

## USING THE UNIT FOR ELECTROSURGERY

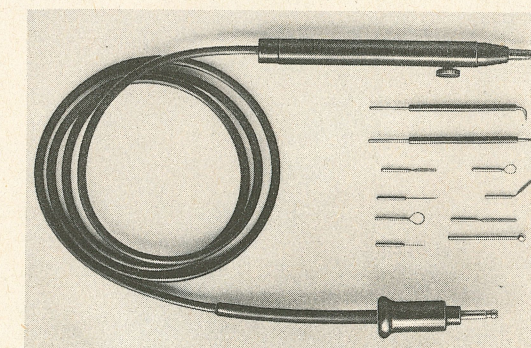
The electrosurgical circuit in the SW-227, as in all Short Wave Diathermies, is limited in its scope due to the lack of hemostatic qualities necessary in electrosurgical procedures where the tissue is vascular. This is true of all vacuum tube circuits. The SW-227 is recommended for only minor office procedures and is set up as follows for electrosurgical work:

A Pad is used as the indifferent electrode and is plugged into the right hand Pad terminal marked, "Surgery Inactive". This Pad is spaced away about 1 inch from the patient, using four felt spacers or equivalent and is usually placed on the thigh.

The active electrode, (Chuck Handle and Cord) is plugged into the Pad terminal on the left-hand side of the machine, marked "Surgery Active".

The Resonance Control is placed at that section of the dial marked "Sur." The Power Control is then used to regulate the electrosurgical current.

NOTE: The Chuck Type Handle on the SW-227 incorporates an "On and Off" switch which affords good control of the vacuum tube electrosurgical circuit. Therefore, no footswitch is needed or supplied with the Model SW-227.



It is suggested that the operator find the approximate settings for electrosurgery by placing the inactive Pad electrode on his own thigh and testing the unit on a piece of meat held in his left hand. In this manner, it is possible to obtain a situation approximating those encountered in actual electrosurgical procedures.

## APPROXIMATE SETTINGS FOR ELECTROSURGICAL USE

	Power Control	Resonance Control
Light Coagulation	6	SUR.
Medium Coagulation	7	SUR.
Heavy Coagulation	8	SUR.
Cutting	6 - 9	SUR.

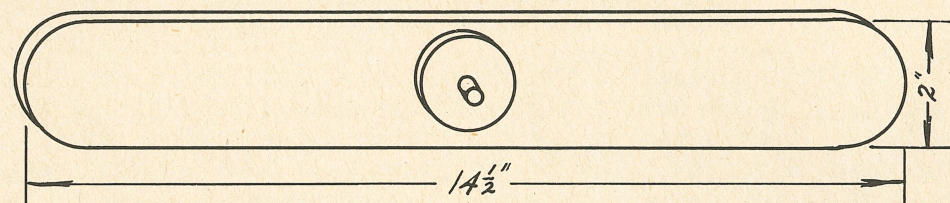


The connecting cords from the Chuck Handle and the inactive Pad electrode should be kept as far apart as possible.

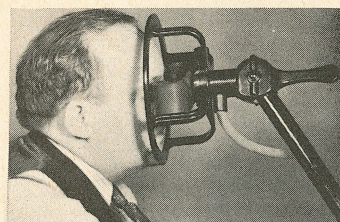
When using the unit for electrosurgery, remember that you are working in the presence of electrical sparks which may ignite inflammable cleansing liquids, solvents or explosive gases. Allow time for complete evaporation of alcohol or other inflammable fluids before applying the current and do not use ethylene, cyclopropane, open ether or other dangerously explosive anaesthetics.

#### AIR-SPACED UTILITY APPLICATOR

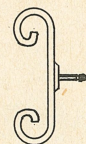
A Special Applicator Available as an Extra to Standard Accessories



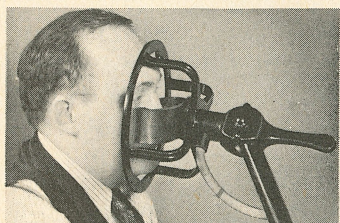
An effective applicator for localizing therapeutic heat over small areas and for application to neck, axilla, etc. Particularly useful to Otolaryngologists.



Treating Eyes



Shape of Applicator



Treating Antra

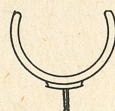
When treating the eyes or antra, the Plate Guard is used for stabilization of the head. The chin rests against the lower edge of the guard when applicator is positioned over eyes; against the patient's forehead when treating the antra. (Allow about 1/2" spacing.) To treat one eye or one antrum, bend the applicator away from the side not to be treated.

For treating the throat, bend applicator into a "U" shape as illustrated. Use 1/2" to 1" of towel spacing which may, if desired, be attached to applicator by rubber bands. To treat axillary abscess, the Utility Applicator is bent backward to form an inverted "U". This is a practical and convenient application, permitting concentration of energy exactly where needed. Spacing of 1/2" to 1" is suggested.

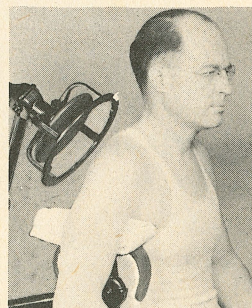
In each treatment the dispersive plate is spaced about 2" away from the patient's back.



Treating Neck



Shape of Applicator



Treating Axilla



Shape of Applicator

## — SECTION VII —

### GENERAL PRECAUTIONS

#### FOR PROTECTION OF PATIENT AND OPERATOR:

1. Be sure that metal cabinet is properly grounded in accordance with grounding instructions furnished. Shock to patient or operator is otherwise possible.

2. To avoid skin burns, always use ample spacing between treatment applicators and patient's skin, keep applicator leads well away from contact with patient and maintain treatment heat below patient's tolerance at all times. (Heat-insensitive patients should not be treated. Determine heat sensitivity with each patient in advance of treatment.)

3. Metal heats rapidly and intensively in the presence of radio frequency energy and to avoid burns from this source, all metal objects on patient's person must be removed from the field or vicinity of the applicators. (Look for and remove hair pins, lingerie buckles, pins, garter buckles, necklaces, charms, watches, chains, corsets with metal stays, spectacles, earrings, collar buttons, tie clasps, etc., and be careful about treatment of patients with history of orthopedic surgery.)

4. Patients wearing hearing aids should remove the aids and place them at least 48" away from the diathermy during treatments. Failure to do this may damage the hearing aids.

5. Warn patients against touching leads or applicators during treatment and be careful that applicator does not slip off spacing material during treatment and contact the skin.

6. Cotton filled cushions, "inner spring" mattresses and keratol (imitation leather) table tops and pads have been known to heat to the burning point from contact with short wave applicators and it is important to keep applicators or leads at least 4" away from all such articles.

7. After treatment of any duration, a "cooling off" period should be allowed before dismissing the patient from your office (especially in cold weather).

8. When using the unit for electrosurgery, remember that you are working in the presence of electrical sparks which may ignite inflammable cleansing liquids, solvents or explosive gases. Allow time for complete evaporation of alcohol or other inflammable fluids before applying the current and do not use ethylene, cyclopropane, open ether or other dangerously explosive anaesthetics.

#### For Protection of Machine and Applicators:

1. Be sure that plugs are pushed all the way in and that they are connected to the proper terminals for the applicator being used.

2. When pulling plugs out of terminals, grasp the plug, not the cord.

3. Always use an individual outlet. Do not connect machine to same outlet with other appliances.

4. Always separate applicators at least four inches from metal table, metal objects, cabinet of machine, inner spring mattresses or keratol covered pads or cushions. Do not cross applicator leads or allow them to come in contact with metal. (See use of Drum Lead Clamp Pg. 5).

5. Avoid breakage of Treatment Drums by careful handling and do not tighten holding screws excessively.



— SECTION VIII —

SERVICE NOTES

**TUBES:** It is to be expected that after prolonged use, the vacuum tube will run out its normal life cycle and will need replacing. A new tube should be ordered direct from Company or through the representative who supplied the machine. Tubes supplied by us are tested thoroughly for maximum electro-therapeutic service. This insures your getting proper tubes from which best results can be obtained.

As a rule, the tube does not burn out -- there will simply be noted a gradual decrease in the current output of the machine. Continue to use the tube until the output falls below a satisfactory therapeutic value. In ordering a new tube, be sure to give serial number of your machine, as several types of tubes are in use, and you must have the proper tube for your particular unit.

Continued blowing of fuses or persistent buzzing of the Protect-A-Tube may indicate that the oscillator tube is "gassy" and should be replaced. Reorder from The Liebel-Flarsheim Company.

A "defective" tube should be returned for inspection in same container in which replacement tube is received. Tubes proving defective in service within the guarantee period will be adjusted, based on the use they have provided.

**REPLACING PILOT LIGHT:** Should pilot burn out, a new one may be inserted by removing back panel, making sure the supply cable first is disconnected. The pilot lamp socket can be dropped down by pulling socket from friction clamp. Remove bulb from socket, replace, and put socket firmly back into position.

**APPLICATORS:** As all rubber deteriorates somewhat under the influence of heat, it will be necessary to replace the rubber covered electrodes after long use. This will occur only after a long time, but should be looked out for. Long exposure to the rays of the sun or an ultra-violet lamp also deteriorates the rubber. If the rubber develops cracks, becomes "spongy" or brittle, this indicates that replacements are in order.

ALWAYS GIVE SERIAL NUMBER OF MACHINE  
WHEN WRITING FOR INFORMATION OR REPLACEMENT PARTS.

*The* LIEBEL  FLARSHEIM Co.  
CINCINNATI 2, OHIO



**SW-227 ACCESSORIES**

★ CHECK with this list when unpacking

- |                                                                                                                                                      |                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> 1-Oscillator Tube. <input checked="" type="checkbox"/> With Unit.<br><input type="checkbox"/> Packed Separately. | <input checked="" type="checkbox"/> 1-Supply Cable with Ground Leads (3 Wire.)    |
| <input checked="" type="checkbox"/> 1-Set Instructions.                                                                                              | <input type="checkbox"/> 1-11 Ft. Inductance Cable.                               |
| <input checked="" type="checkbox"/> 1-Grounding Lead.                                                                                                | <input type="checkbox"/> 4-Inductance Cable Clips.                                |
| <input checked="" type="checkbox"/> 2-Thumb Screws.                                                                                                  | <input checked="" type="checkbox"/> 1-Adjustable Arm (Packed Separately).         |
| <input type="checkbox"/> 2-6 x 8-½ Pad Applicators—Ultra.                                                                                            | <input type="checkbox"/> 2-Adjustable Arms for Spaced Plates (Packed Separately). |
| <input type="checkbox"/> 4-Felt Spacers.                                                                                                             | <input type="checkbox"/> 2-Plate Guards with Discs.                               |
| <input checked="" type="checkbox"/> 1-Hinged Drum.                                                                                                   | <input type="checkbox"/> 2-Spaced Plates 7".                                      |
| <input checked="" type="checkbox"/> 1-Set of Drum Lead Spacers—two pieces (Packed with Arm).                                                         |                                                                                   |